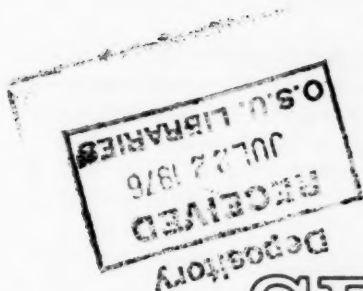


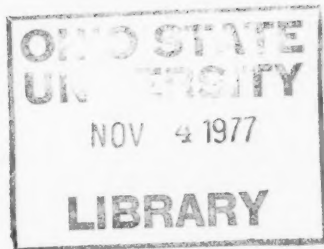
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SELECTED ≡ WATER RESOURCES ABSTRACTS



VOLUME 9, NUMBER 13
JULY 1, 1976

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SELECTED WATER RESOURCES ABSTRACTS

A Semimonthly Publication of the Water Resources Scientific Information Center, Office of Water Research and Technology,
U.S. Department of the Interior



VOLUME 9, NUMBER 13
JULY 1, 1976

W76-06151 -- W76-06800

The Secretary of the U.S. Department of the Interior has determined that the publication of this periodical is necessary in the transaction of the public business required by law of this Department.

ment. Use of funds for printing this periodical has been approved by the Director of the Office of Management and Budget through August 31, 1978.

As the Nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering the wisest use of our land and water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historical places, and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to assure that their development is in the best interests of all our people. The Department also has a major responsibility for American Indian reservation communities and for people who live in Island Territories under U.S. administration.

FOREWORD

Selectd Water Resources Abstracts, a semimonthly journal, includes abstracts of current and earlier pertinent monographs, journal articles, reports, and other publication formats. The contents of these documents cover the water-related aspects of the life, physical, and social sciences as well as related engineering and legal aspects of the characteristics, conservation, control, use, or management of water. Each abstract includes a full bibliographical citation and a set of descriptors or identifiers which are listed in the **Water Resources Thesaurus**. Each abstract entry is classified into 10 fields and 60 groups similar to the water resources research categories established by the Committee on Water Resources Research of the Federal Council for Science and Technology.

WRSIC IS NOT PRESENTLY IN A POSITION TO PROVIDE COPIES OF DOCUMENTS ABSTRACTED IN THIS JOURNAL. Sufficient bibliographic information is given to enable readers to order the desired documents from local libraries or other sources.

Selected Water Resources Abstracts is designed to serve the scientific and technical information needs of scientists, engineers, and managers as one of several planned services of the Water Resources Scientific Information Center (WRSIC). The Center was established by the Secretary of the Interior and has been designated by the Federal Council for Science and Technology to serve the water resources community by improving the communication of water-related research results. The Center is pursuing this objective by coordinating and supplementing the existing scientific and technical information activities associated with active research and investigation program in water resources.

To provide WRSIC with input, selected organizations with active water resources research programs are supported as "centers of competence" responsible for selecting, abstract-

ing, and indexing from the current and earlier pertinent literature in specified subject areas.

Additional "centers of competence" have been established in cooperation with the Environmental Protection Agency. A directory of the Centers appears on the inside back cover.

Supplementary documentation is being secured from established discipline-oriented abstracting and indexing services. Currently an arrangement is in effect whereby the Bio-Science Information Service of Biological Abstracts supplies WRSIC with relevant references from the several subject areas of interest to our users. In addition to Biological Abstracts, references are acquired from Bioresearch Index which are without abstracts and therefore also appear abstractless in SWRA. Similar arrangements with other producers of abstracts are contemplated as planned augmentation of the information base.

The input from these Centers, and from the 51 Water Resources Research Institutes administered under the Water Resources Research Act of 1964, as well as input from the grantees and contractors of the Office of Water Research and Technology and other Federal water resource agencies with which the Center has agreements becomes the information base from which this journal is, and other information services will be, derived; these services include bibliographies, specialized indexes, literature searches, and state-of-the-art reviews.

Comments and suggestions concerning the contents and arrangements of this bulletin are welcome.

Water Resources Scientific Information Center
Office of Water Research and Technology
U.S. Department of the Interior
Washington, DC 20240

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01 NATURE OF WATER

Includes the following Groups: Properties; Aqueous Solutions and Suspensions

02 WATER CYCLE

Includes the following Groups: General; Precipitation; Snow, Ice, and Frost; Evaporation and Transpiration; Streamflow and Runoff; Groundwater; Water in Soils; Lakes; Water in Plants; Erosion and Sedimentation; Chemical Processes; Estuaries.

03 WATER SUPPLY AUGMENTATION AND CONSERVATION

Includes the following Groups: Saline Water Conversion; Water Yield Improvement; Use of Water of Impaired Quality; Conservation in Domestic and Municipal Use; Conservation in Industry; Conservation in Agriculture.

04 WATER QUANTITY MANAGEMENT AND CONTROL

Includes the following Groups: Control of Water on the Surface; Groundwater Management; Effects on Water of Man's Nonwater Activities; Watershed Protection.

05 WATER QUALITY MANAGEMENT AND PROTECTION

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06 WATER RESOURCES PLANNING

Includes the following Groups: Techniques of Planning; Evaluation Process; Cost Allocation, Cost Sharing, Pricing/Repayment; Water Demand; Water Law and Institutions; Nonstructural Alternatives; Ecologic Impact of Water Development.

07 RESOURCES DATA

Includes the following Groups: Network Design; Data Acquisition; Evaluation, Processing and Publication.

08 ENGINEERING WORKS

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09 MANPOWER, GRANTS, AND FACILITIES

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10 SCIENTIFIC AND TECHNICAL INFORMATION

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SUBJECT INDEX

AUTHOR INDEX

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ABSTRACT SOURCES

SELECTED WATER RESOURCES ABSTRACTS

1. NATURE OF WATER

1A. Properties

THERMODYNAMIC PROPERTIES OF BULK AND OCCLUDED SUPER-COOLED WATER AND IONIC SOLUTIONS,
Purdue Univ., Lafayette, Ind. Water Resources Research Center.
C. A. Angell.

Available from the National Technical Information Service, Springfield Va 22161, as PB-251 543, \$4.00 in paper \$2.25 in microfiche. OWRT B1051-IND (7). Technical Report No. 75, January 1976. 29 p, 11 fig, 20 ref.

Descriptors: *Thermodynamic behavior, *Supercooling, *Thermal capacity, *Nucleation, *Crystallization, Freezing, *Physicochemical properties, Thermal properties, *Compressibility, Infrared spectra, Emulsions, *Aqueous solution, *Water properties, Ions, Water structure, *Electrolytes, Water types, Water analysis, Analytical techniques, Infrared radiation, Measurement, Expansivity, Infrared spectra.

Techniques have been developed for performing quantitative determinations, of the heat capacity, compressibility, and near infrared spectra, of pure water, D₂O, and their electrolyte solutions under conditions of supercooling amounting to as much as 38°C in the case of pure water and > 120°C for certain concentrated electrolyte solutions. In the latter cases glasses form, and some of their properties have been determined. In the case of pure water, which has been the focus of this study, remarkable anomalies are encountered in the supercooled regime. The heat capacity, compressibility, and negative expansivity are increasing exponentially with decreasing temperature according to a function which suggests the existence of a thermodynamic singularity at -45°C. This phenomenon is dependent on extended water-water interactions since it is rapidly eliminated by addition of electrolytes such as LiCl. Alternative interpretations of these phenomena are discussed, with focus on the possible existence of internal liquid phase lambda transitions associated with open hydrogen bonded networks or the existence of a low temperature limit on the mechanical stability of water as a liquid phase. A concentrated aqueous electrolyte solution, 5.5 m lithium acetate, is found to form a glass for which the glass transition temperature pressure dependence is negative, the first such example on record.
W76-06155

1B. Aqueous Solutions and Suspensions

THERMODYNAMIC PROPERTIES OF BULK AND OCCLUDED SUPER-COOLED WATER AND IONIC SOLUTIONS,
Purdue Univ., Lafayette, Ind. Water Resources Research Center.
For primary bibliographic entry see Field 1A.
W76-06155

2. WATER CYCLE

2A. General

LEVEL OF CLOSED BODIES OF WATER AS ONE OF THE CRITERIA OF GLOBAL WATER EXCHANGE,
Akademiya Nauk SSSR, Moscow. Institut Vodnykh Problem.
G. P. Kalinin, and R. K. Klige.
Soviet Hydrology, Selected Papers, No. 6, p 534-538, 1973. 6 fig, 7 ref. Translated from (Water Resources) Vodnyye resursy, No. 6, p 3-8, 1973.

Descriptors: *Water level fluctuations, *Lakes, *Oceans, *Humidity, Precipitation(Atmospheric), Runoff, Evaporation, Surface waters, Volume, Sea level, Water levels.
Identifiers: *Closed lakes, *USSR.

The total volume of water contained in the lakes of the earth is about 750,000 cu km and the total area of the lakes is about 2.7 million sq km. The life of these bodies of water is very closely related to the total hydrologic budget of our planet. It is natural, therefore, that the volume of lakes, their surface area, and the water level in them depend on the total humidity of the continents. This relation is most pronounced for closed lakes whose surface area is fairly large. These lakes are unique indicators of climatic variations. When the humidity of continents increases, so does the volume of closed lakes, their level rises, and their surface area increases. Conversely, the area of closed lakes decreases markedly during dry periods. An analysis of fluctuations in the level of the world's largest closed lakes showed a definite tendency toward a drop in the last century. There is a definite relation between the change in the level and volumes of the largest closed lakes and that of the World Ocean. For the level regime it is practically immaterial whether the land water will be supplied by river or atmospheric runoff while water exchange is changing i.e., a change in runoff may have no effect on the ocean level. The situation is essentially different for lakes, since most of the moisture evaporated from the lake surface is carried beyond the limits of the lake's drainage basin. Therefore, a change in river runoff leads to a direct change in the equilibrium level of a lake. (Sims - ISWS)
W76-06179

OPTIMUM DREDGED DEPTH IN INLAND WATERWAY,
CACI, Inc., Arlington, Va.
For primary bibliographic entry see Field 2J.
W76-06182

DATA COLLECTION SYSTEMS AND THEIR IMPACT ON THE FUTURE DEVELOPMENT OF HYDROLOGY,
Department of the Environment, Reading (England). Water Data Unit.
For primary bibliographic entry see Field 7A.
W76-06277

METHOD FOR DETERMINATION OF DESIGN STORMS WITH LOCALLY NONUNIFORM DISTRIBUTION (VERFAHREN ZUR ERMITTLUNG EINES 'BERECHNUNGSREGENS' MIT ORTLICH UNGLEICHMAESSIGER VERTEILUNG),
F. Sieker.
Wasserwirtschaft, Vol. 65, No. 11, p 293-296, 1975. 4 fig, 1 tab, 5 ref.

Descriptors: *Design storm, *Precipitation(Atmospheric), *Statistical methods, *Rainfall, *Storm water, Mathematical models, Analytical techniques, Distribution.

Applying multi-variable statistical variance analysis design storms with locally nonuniform distribution patterns can be developed. This analysis approach takes into account the stationary nonuniform rainfall-distribution due to orographic and topographic irregularities, the ratio between longitudinal and lateral expansion of rainfall areas as well as directional effects, the rainfall-occurrence-probability related to the average intensity of that rainfall, and causally nonattachable irregularities. The method is illustrated in this article by an example using daily precipitation curves. (Loustau-FIRL)
W76-06299

DISTRIBUTION FUNCTIONS LIMITED AT THE ORIGIN (IM URSPRUNG BEGRENZTE VERTEILUNGSFUNKTIONEN),
P. H. Mueller, W. Traus, and H. Vahl.
Wasserwirtschaft, Vol. 65, No. 11, p 296-301, 1975. 2 fig, 7 tab, 14 ref.

Descriptors: *Statistical methods, *Mathematical studies, *Hydrology, *Time series analysis, Synthetic hydrology, Distribution.
Identifiers: *Hydrological time series.

In order to better adapt a hydrological time-series to the actual physical conditions, it is desirable to transform left limited distribution functions in such a way that they begin in the origin. A method for performing this transformation was applied to the Pearson-Type-3-Distribution and to the Extremal-Type-3-Distribution. The K-values of the distribution functions gained in this way have been computed. For the simple application of the chi squared test, the tables for the standardized density functions have also been added. (Orr-FIRL)
W76-06316

EARTHWATCH,
National Oceanic and Atmospheric Administration, Rockville, Md. Deep Water Ports Project Office.
For primary bibliographic entry see Field 5A.
W76-06321

CONTROLLING POLLUTION FROM COMBINED SEWERS,
Hydrocomp, Inc., Palo Alto, Calif.
For primary bibliographic entry see Field 5D.
W76-06328

A COMBINED MODEL OF WATER TABLE AND RIVER STAGE EVOLUTION,
Colorado State Univ., Fort Collins. Engineering Research Center.
H. J. Morel-Seytoux.
Water Resources Research, Vol. 11, No. 6, p 968-972, December 1975. 29 ref. OWRT B-109-COLO(6). 14-31-0001-4067.

Descriptors: *Surface-groundwater relationships, Streamflow, *Aquifer systems, *Aquifer characteristics, *Groundwater movement, *Simulation analysis, *Model studies, Aquifers, Pumping, Flood stages, Flood flow, Return flow, Hydrology, Hydraulics, Momentum equation.
Identifiers: Pumping rates, Aquifer interaction, Kernels, Muskingum routing, Gaussian algorithm, Mathematical simulation.

An integral equation was derived which completely characterizes the interaction between a stream and the alluvial aquifer. Expressed in finite difference form, the equation was of great practical utility in solving flooding problems (i.e., negligible effect of pumping on river flows) as it relates river stages to return flows. It was also useful to solve pure conjunctive use of surface water and groundwater problems (i.e., negligible river stage fluctuations) as it relates return flows to pumping rates, or to solve composite problems. The numerical procedures to calculate the response function coefficients in terms of the physical characteristics of the system were given in detail. (Terstriep-ISWS)
W76-06380

MODELING TECHNIQUES FOR GROUND-WATER EVALUATION,
Illinois State Water Survey, Urbana.
For primary bibliographic entry see Field 2F.
W76-06413

Field 2—WATER CYCLE

Group 2A—General

RAINFALL-RUNOFF DATA FROM SMALL WATERSHEDS IN COLORADO, OCTOBER 1971 THROUGH SEPTEMBER 1974. Geological Survey, Denver, Colo.
For primary bibliographic entry see Field 7C.
W76-06446

GEOLOGIC AND WATER-SUPPLY REPORTS AND MAPS--WYOMING, JULY 1975. Geological Survey, Reston, Va.
For primary bibliographic entry see Field 10C.
W76-06456

OPTIMAL SAMPLING AND OBJECTIVE ANALYSIS. Eddy (Amos), Inc., Norman, Okla.
For primary bibliographic entry see Field 2B.
W76-06609

HYDROLOGICAL FORECASTING PRACTICES. World Meteorological Organization, Geneva (Switzerland). Working Group on Hydrological Forecasting.
Operational Hydrology Report No. 6, WMO - No. 425, 1975. 122 p, 35 fig, 1 tab, 158 ref.

Descriptors: *Hydrology, *Forecasting, Floods, Water resources, Flood stages, Flood forecasting, Snowmelt, Human population, Discharge(Water), Rainfall, Rivers, River flow, Rainfall-runoff relationships, Water supply, Ice, Reservoirs, Navigation, Reach(Streams), Freezing.
Identifiers: *Hydrological forecasting, Human lives, Snowmelt floods, Rainfall-induced floods, Ice break-up, River navigation.

Basic principles of, and approaches to, hydrological forecasting were summarized for readers with little previous exposure to the subject. The first three chapters included introductory material placing hydrological forecasting in the broader perspective of hydrology separate from water resources. The term was defined as a prediction of the occurrence of a hydrological event specified both with respect to its quantitative measure and its actual time of occurrence, as opposed to a statistical prediction. The data needed for forecasting were listed as raw material. The most important specific types of hydrological data were described in chapters 4 to 9. Flood forecasting was described as well as possibilities of predicting water supply within long periods of time. There was a chapter on low flows in rivers, that is, the rate at which the water supplies of a basin vanish when there is no water input. Ice phenomena on rivers and reservoirs were discussed from the river navigation standpoint. The report ended with an evaluation of the effectiveness of forecasting methods and the degree of success of operational hydrological forecasts. (Roberts - ISWS)
W76-06633

A GENERALIZED STREAMFLOW SIMULATION SYSTEM, CONCEPTUAL MODELING FOR DIGITAL COMPUTERS. National Weather Service, Sacramento, Calif. River Forecast Center.
R. J. C. Burnash, R. L. Ferral, and R. A. McGuire. Joint Report, National Weather Service and California Department of Water Resources, March 1973, 204 p, 28 fig, 12 ref, 2 append.

Descriptors: *Rainfall-runoff relationships, *Hydrologic systems, *Hydrology, *Simulation analysis, *Streamflow, *Computer models, Infiltration, Evapotranspiration, Percolation, Hydrologic cycle, Subsurface runoff, Storage, Drainage, Soil moisture, Precipitation(Atmospheric).
Identifiers: Conceptual models, *Streamflow simulation, Upper zone storage, Lower zone storage.

The hydrologic simulation model described is a conceptual system for modeling the headwater portion of the hydrologic cycle. It was based on a system of percolation, soil-moisture storage, drainage, and evapotranspiration characteristics representing significant hydrologic processes. The definition of model parameters was achieved by establishing a soil-moisture computation which allows the determination of basin stream flow from basin precipitation. Simulation was normally done using a 24-hour time increment, although a shorter increment can be used. Model parameters are physically based and can be estimated from rainfall-runoff data. The program has gone through several generations of development and has been tested on eight geographically diverse basins totaling 70 station-years of data. (Terstriep-ISWS)
W76-06634

SYNTHESIS OF BASIN RESPONSE WITH INADEQUATE DATA. Osmania Univ., Warangal (India). Regional Engineering Coll.
R. Raghavendran, and P. Javarami Reddy. Nordic Hydrology, Vol. 6, No. 1, p 14-27, 1975. 10 fig, 2 tab, 15 ref.

Descriptors: *Synthetic hydrology, *Hydrologic data, *Runoff, *Parametric hydrology, Streamflow, Model studies, Analytical techniques, Simulation analysis, Basins, Watersheds(Basins).
Identifiers: Basin response function, Inadequate data, *Hydrological analysis, Developing region, *India, Correlated basin characteristics, Discretized basin response.

The study focused on the problem of developing a basin response function with inadequate data. The case of a catchment with some measurements of output and with input data either totally absent or unemployable was specifically taken for analysis. A method proposed earlier was extended to natural catchments from 25 sq mi to 750 sq mi. It was shown that the synthesis is subjected to uncertainties and errors when the method is applied to larger catchments, though reasonably good results are obtained for smaller catchments. An alternate method applicable for all size of catchments, assuming that linearity and time are invariable and that the parameters of the model are correlated with catchment characteristics, was suggested. (Morris - ISWS)
W76-06675

RAPID RECHARGE IN A LIMESTONE AQUIFER. Birmingham Univ., (England). Dept. of Civil Engineering.
For primary bibliographic entry see Field 2F.
W76-06685

THE STREAM AND ITS VALLEY. H. B. N. Hynes. Verhandlungen Internationale Vereinigung Limnologie, Vol. 19, Part 1, p. 1-15, 1975. 4 fig., 2 tab., 72 ref.

Descriptors: *Ecosystems, *Running waters, *Watersheds(Basins), Lotic environments, Water sources, Hydrology, Transpiration, Organic matter, Litter, Vegetation, Precipitation(Atmospheric), Ions, Nutrients, Geochemistry, Productivity, Fulvic acids, Biodegradation, Leachate, Detritus.

The ecological concept of a stream and its watershed is substantiated by the latest scientific research and an overview of the interrelations between the valley and the lotic environment is presented. Among the concepts discussed is that the stream derives most of its energy from the uplands; that the source of organic matter is only indirectly dependent on vegetation litterfall, and its availability to benthic invertebrates and the biodegradation process depend on the vegetation

type; and that the biotic energy that derives the stream communities begins in the form of dead material. There is evidence that decaying litter, or probably it biodegradation, take up a great deal of ionic nitrogen from the water and convert it to protein. The various inputs, sources, and transformations of organic matter are delineated. The sources of water in streams are not as generally supposed overland flow, but rather it is the soil of the valley which yields water over extend periods of time. Recent research propounds that transpiration can control stream discharge even during the non-growing season. The origin of nutrients and movement through the ecosystem, the reactions between ions and humic and fulvic acids, the temperature and climatic differences and how they affect productivity are also discussed. (Auen-Wisconsin)
W76-06722

2B. Precipitation

THE INTERPRETATION OF THE CRYSTALLINE AND AIR BUBBLE STRUCTURES OF HAIL STONES. Western Australia Univ., Nedlands. Dept. of Physics.
W. C. Macklin, J. N. Carras, and P. J. Rye. Quarterly Journal of the Royal Meteorological Society, Vol. 102, No. 431, p 25-44, January 1976. 13 fig, 3 tab, 32 ref.

Descriptors: *Hail, *Cloud physics, Crystals, Bubbles, Ice, Analysis, Thunderstorms, Temperature, Meteorology.
Identifiers: *Hailstones, *Hailstone growth, Updrafts.

It is now possible to ascertain the growth histories of hailstones of approximately spherical symmetry from studies of their internal structure. Six large hailstones 4 to 6.5 cm maximum dimension, two from each of three severe storms, were analyzed. The orientation distributions and sizes of the crystals in the hailstone layers indicated that most of the growth of the hailstones took place at ambient temperatures between about -20 and -25 C, i.e., between 2.7 and 3.7 km above the freezing level. The air bubble concentrations and size distributions showed that all the hailstones grew with surface temperatures ranging from -1C for the clear layers to about -11 C for the opaque layers comprised of very small crystals. On the assumption that the median volume radius of the cloud droplet distribution was 10 micrometers, the growth of most of the hailstones took place in liquid water concentrations of about the adiabatic values. However, fluctuations in the liquid water concentration of up to some 30% were required to explain the observed air bubble and crystal structures. The fact that the hailstones grew largely between the -20 and -25 C levels indicated that they were balanced in the updraft for most of their history. (Sims-ISWS)
W76-06167

PRODUCTION OF SECONDARY ICE PARTICLES DURING THE GROWTH OF GRAUPEL BY RIMING. Commonwealth Scientific and Industrial Research Organization, Epping (Australia), Div. of Cloud Physics.
S. C. Mossop. Quarterly Journal of the Royal Meteorological Society, Vol. 102, No. 431, p 45-57, January 1976. 8 fig, 1 tab, 20 ref.

Descriptors: *Cloud physics, Graupel, *Rime, Laboratory tests, Particle size, Ice, Crystals, Drops(Fluids), Raindrops, Temperature, Meteorology.
Identifiers: *Ice particles, *Graupel growth, Cloud chamber, Drop size spectrum, Collection efficiency.

Experiments indicated that secondary ice crystals are produced when rime grows in a supercooled cloud containing drops greater than or equal to 24 micrometer in diameter. This occurs between temperatures of -3 and -8 C, the production rate being greatest at -5 C. These temperatures are constant to about \pm or -0.5 deg C for velocities of the rime body ranging from 1.4 to 3.0 m/s. On the average one ice splinter is thrown off for every 250 drops of diameter greater than or equal to 24 micrometer accreted, at cloud temperature -5 C, and this value does not change much with target velocity. Various possible splintering mechanisms were discussed. (Sims-ISWS)
W76-06168

NITROGEN AND SULFUR CONTENT AND PH OF PRECIPITATION IN IOWA, Iowa State Univ., Ames. Dept. of Agronomy. For primary bibliographic entry see Field 5C.
W76-06208

DROUGHT AND AGRICULTURE, World Meteorological Organization, Geneva. (Switzerland). C. E. Hounam, J. J. Burgos, M. S. Kalik, W. C. Palmer, and J. Rodda. Technical Note No. 138, WMO-No. 392, 1975. 127 p, 16 fig, 22 tab, 370 ref, 2 append.

Descriptors: *Droughts, *Arid lands, *Agriculture, *Meteorology, *Analytical techniques, *Land management, Water balance, Water requirements, Bibliographies, Crop response, Drought resistance, Moisture stress, Plant physiology, Weather modification, Precipitation (Atmospheric), Plant growth, Air temperature, Humidity, Soil moisture, Pest control, Diseases, Livestock.

The many meteorological facets of drought are discussed including its definition and early recognition, its effect on plants, animals, and diseases, as well as its amelioration and methods for surviving under its influence. Definitions of drought are examined according to whether they are based on rainfall only, on combinations of rainfall with temperature, humidity, wind or evaporation, on soil moisture, or on plant condition. Special attention is given to various interpretations of the water-balance equation such as the Palmer model. Agricultural practices under drought conditions are discussed including the drought resistance of plants and seeds, the use of fallow as a management technique under dry conditions, the danger of erosion of drought-affected soils, and the effects of drought on pastures and livestock. Water requirements under drought conditions are also described, and it is shown that management practices and hydrologic structures can be used to lessen the impact of drought. Although drought is generally detrimental to agriculture, it may greatly reduce economic losses from some pests and diseases. Certain agricultural practices such as wind barriers, fallowing, weather modification, evaporation suppression, and cloud seeding can influence meteorological conditions in the plant/soil environment, and may be used to advantage under drought conditions. Application of standard statistical techniques which have already been used with some success in drought studies is discussed, and some examples are given. (Robnett-Arizona)
W76-06265

THE BLACK HILLS (SOUTH DAKOTA) FLOOD OF JUNE 1972: IMPACTS AND IMPLICATIONS, Forest Service (USDA), Fort Collins, Colo. Rocky Mountain Forest and Range Experiment Station. For primary bibliographic entry see Field 2E.
W76-06360

SODIUM, POTASSIUM, CALCIUM AND MAGNESIUM CONTENT OF NORTHWEST ARKANSAS RAIN WATER IN 1973, Arkansas Univ., Fayetteville. Dept. of Geology. G. H. Wagner, and R. W. Holloway. Journal of Applied Meteorology, Vol. 14, No. 4, p 578-584, June 1975. 9 fig, 5 tab, 8 ref. OWRT A-025-ARK(4).

Descriptors: *Rain water, *Chemistry of precipitation, *Arkansas, Chemistry, Rainfall, Precipitation (Atmospheric), Sodium, Potassium, Calcium, Magnesium, On-site data collections, Sampling, Meteorology.

Individual rains falling on Fayetteville, Arkansas, in 1973 were analyzed for sodium, potassium, calcium, and magnesium. Compared to a drier year, 1955-1956, the average concentrations of these elements were lower in 1973 but the fluxes higher, except calcium. Each element had a peak flux in the spring and fall, corresponding to the peaks in the amount of rainfall. Calcium concentration relative to the other elements was uniquely high during late winter and early fall suggesting more wind dependence for calcium. The elemental ratios were near those for crustal rocks, not seawater. The monthly fluxes of sodium, potassium, and magnesium were nearly constant with increasing rainfall up to six inches per month, then they increased more steeply. Calcium monthly flux increased linearly with increasing rainfall. Extrapolation of the monthly flux to zero rainfall gives a measure of the dry fallout contributed to the fluxes obtained with open collectors. Dry fallout and wet fallout (rain) were about equal. (Sims-ISWS)
W76-06379

A COMPARISON OF THE RESPONSES OF IDENTICAL CUP ANEMOMETERS MOUNTED ON A SPAR AND A TOROID BUOY, Oregon State Univ., Corvallis. School of Oceanography. For primary bibliographic entry see Field 7B.
W76-06392

CHANGES IN CLIMATE AND ESTIMATED EVAPORATION ACROSS A LARGE IRRIGATED AREA IN IDAHO, Wyoming Univ., Laramie. Dept. of Agricultural Engineering. For primary bibliographic entry see Field 2D.
W76-06406

PHYSICAL AND CLIMATIC CHARACTERISTICS ALONG KANSAS STREAMS, Geological Survey, Lawrence, Kans. For primary bibliographic entry see Field 7C.
W76-06450

FACTORS ALTERING THE MICROCLIMATE IN CARLSBAD CAVERNS, NEW MEXICO, Geological Survey, Albuquerque, N. Mex. For primary bibliographic entry see Field 2D.
W76-06452

CASCADE ATMOSPHERIC WATER RESOURCES PROGRAM, VOLUME 3, Washington State Dept. of Ecology, Olympia. P. V. Hobbs, L. F. Radke, R. R. Weiss, D. G. Atkinson, and J. D. Locatelli. Report No. VIII, May 1, 1975, 18 p. 14-06-D-6999

Descriptors: *Artificial seeding, Mountains, Cyclonic storms, Orographic clouds, Snowfall, *Weather modification, *Washington, *Cloud seeding, Precipitation (Atmospheric). Identifiers: *Cascade Mountains (Wash).

Studies were carried out during 1972-73 of winter cyclonic storms, orographic clouds and precipitation over the Cascade Mountains of Washington State and their modifications by artificial cloud

seeding. Summaries of the principal accomplishments and conclusions arrived at in the 3-year (1970-73) study are also presented. (See also W76-06600 and W76-06601) (Bureau of Reclamation)
W76-06602

DETERMINATION OF R-Z RELATIONSHIPS FOR WEATHER RADAR USING COMPUTER OPTIMIZATION TECHNIQUES, South Dakota School of Mines and Technology, Rapid City. Inst. of Atmospheric Sciences. P. L. Smith, Jr., D. E. Cain, A. S. Dennis, and J. R. Miller, Jr. Report 75-3, April 1975. 14-06-D-6660

Descriptors: *Cloud seeding, *Computer models, *Optimization, Hail, Hydrology, Precipitation, Radar, Reflectivity, Rainfall, *Weather modification, *North Dakota, Data collections. Identifiers: R-Z relationship.

Quantitative radar data were collected from a 10-cm radar data set in western North Dakota during the summer of 1972 in connection with a randomized pilot project of cloud seeding. The radar data were recorded on magnetic tape for subsequent computer reduction and analysis. The computed radar reflectivity factors have been compared with rain gage observations collected by a network of 22 recording rain gages to obtain a relationship between hourly rainfall accumulation and the observations of the radar reflectivity factor Z. The relationship was obtained by applying a computer optimization technique resulting in the formula $Z = 155R^{1.88}$. Comparison of point and area rainfall estimates obtained by applying this formula to estimates based on a network of 80 conventional rain gages in the area leads to the following conclusions: (1) The absolute radar calibration was maintained to within ± 1 dB during the summer. (2) With such accurate calibration, radar can lead to estimates of areal rainfall over the season within 10% to 15% of the rain gage estimates even using a standard R-Z relationship. (3) Some further improvement can be obtained by using an optimized R-Z relationship appropriate to the area, such that very close agreement can be obtained in terms of total rainfall accumulation over a season. (4) For operational measurement of areal rainfall by radar, corrections for evaporation and other meteorological variables will be necessary. (Bureau of Reclamation)
W76-06604

DEVELOPMENT OF AN EXPERIMENTAL HYDROMETEOROLOGICAL DATA COLLECTION NETWORK, Western Scientific Services, Inc., Fort Collins, Colo. J. H. Wagner. Report FR-807-40, February 11, 1975. 14-06-D-7551

Descriptors: *Data collections, *Precipitation gages, *Precipitation (Atmospheric), Satellites (Artificial), Telemetry, Digital systems, Hydrometeorological station, *Remote sensing, *Networks. Identifiers: Remote data stations, ERTS.

Two techniques for automatic collection of data from remote precipitation gages are described. Both techniques utilize a digital precipitation gage developed as a part of this program. The ERTS-RAIN concept is designed for a network of gages operating within a 12 mile radius of an ERTS Data Central. The Airborne-RAIN concept is designed for data collection from a network of gages operating over an area of several thousand square miles. Experimental systems were developed and tested in order to demonstrate the feasibility of both concepts. Recommendations for implementation of prototype networks for evaluating the operational aspects of the network are included. (Bureau of Reclamation)
W76-06606

Field 2—WATER CYCLE

Group 2B—Precipitation

EVALUATION OF AIRBORNE RAINDROP SIZE-DISTRIBUTIONS MEASUREMENTS FOR IMPROVING RADAR RAINFALL ESTIMATES, Meteorology Research, Inc., Altadena, Calif. T. B. Smith, D. T. Takeuchi, R. L. Peace, and S. M. Howard.
(1975), 407 p. 14-06-D-7536

Descriptors: *Weather modification, Equipment, Raindrops, Measuring instruments, Rain gages, Spectrometers, Rainfall intensity, *Oklahoma, *Instrumentation, *Networks, Estimating.
Identifiers: Raindrop spectrometers, Washita River watershed (Okla.).

In May of 1974, an experiment was performed to evaluate the potential contribution of airborne measurements and/or surface raingages, for improving the accuracy and reliability of radar measurements of rainfall for evaluation of weather modification experiments. The aircraft was equipped with a PMS (Knollenberg) Precipitation Spectrometer Probe, a Metrodata Rain Rate Meter, and an MRI Hydrometeor Sampler for measurements of raindrop size-distributions. The principal radar used was the WSR-57 radar located at the National Severe Storms Laboratory in Norman, Okla. The raingages were those in the Agriculture Research Service Washita River watershed raingage network located southwest of Norman. The accuracy of the airborne measurements was evaluated by comparing the derived reflectivity values with the WSR-57 measurements and by comparing the computed rainfall intensity values with the surface raingage readings. (Bureau of Reclamation)
W76-06608

OPTIMAL SAMPLING AND OBJECTIVE ANALYSIS, Eddy (Amos), Inc., Norman, Okla. A. Eddy, and J. Brady.
June 27, 1975, 70 p. 14-060-D-7633

Descriptors: *Computer programs, *Rainfall, *Data processing, Climatic data, Optimization, Sampling, Instrumentation, *Model studies.
Identifiers: *Data analysis (Rainfall).

Described are three main projects, each of which centered around providing tested computer programs to the AWRM program of the Bureau of Reclamation operational on the Denver CYBER 70 computer system. Tests were conducted using Illinois State Water Survey rainfall data. (1) Optimal rainfall accumulation time and station density concepts were derived under decision constraints and observation sets input by the user. (2) Optimal interpolation objective analysis routines were implemented. These use either modelled signal and noise covariance functions or data derived covariance functions at the option of the user. (3) Sensor placement routines were provided and tested using as input simply configured shower rainfall patterns the descriptions of which are input by the user in meteorologically familiar terms. (4) A proposed sampling and analysis model is offered. This would effect an optimal combined use of radar reflectivities and surface rain gage measurements. (Bureau of Reclamation).
W76-06609

CHEMICAL/BIOLOGICAL RELATIONSHIPS RELEVANT TO ECOLOGICAL EFFECTS OF ACID RAINFALL, National Ecological Research Lab., Corvallis, Oreg.
For primary bibliographic entry see Field 5A.
W76-06650

USE OF RADAR INFORMATION IN DETERMINING FLASH FLOOD POTENTIAL, National Weather Service, Garden City, N.Y. Eastern Region.
For primary bibliographic entry see Field 4A.
W76-06653

ICE PARTICLE MULTIPLICATION IN CUMULUS CLOUDS, Manchester Univ. (England). Dept. of Mathematics. R. F. Chisnell, and J. Latham.
Quarterly Journal of the Royal Meteorological Society, Vol. 102, No. 431, p 133-156, January 1976. 1 fig, 6 tab, 17 ref, 1 append.

Descriptors: *Model studies, *Cloud physics, *Ice, *Rime, Mathematical models, Drops (Fluids), Raindrops, Particle size, Crystals, Precipitation (Atmospheric), Freezing, Graupel, Stochastic processes, Mathematics, Meteorology.
Identifiers: *Ice particles, Ice splinters, Graupel growth, Drop growth.

Ice particle multiplication in shallow supercooled clouds was described by a stochastic process, which depends on collisions between ice particles and supercooled water droplets and drops. The multiplication is a consequence of the riming and drop splintering processes, or possibly just one of them. In the riming process, a large ice particle collects water droplets which eject splinters on freezing. In the drop splintering process, a supercooled drop which collides with a splinter, freezes and may eject splinters. The probability of collision between an ice splinter and a water drop was estimated by considering their fall velocities and assuming a collection efficiency of unity. As a consequence of the small and large water drop division, the ice splinters are also divided; small ice splinters collide with all water drops, but large splinters having fall velocities comparable with those of small water drops collide only with large water drops. The growth of all ice particles by diffusion of water vapor or accretion of water droplets is taken into account, splinters not captured by water drops grow to rimer status after an appropriate time. Rimers are removed from the system at the time they fall through the OC isotherm. A rimer may also be formed as a result of the freezing of a large supercooled water drop, following its collision with an ice splinter. (Sims-ISWS)
W76-06678

URBAN EFFECTS ON THE DISTRIBUTION OF HEAVY CONVECTIVE RAINFALL, Illinois State Water Survey, Urbana.
For primary bibliographic entry see Field 4C.
W76-06680

AGRICULTURAL DROUGHT OF 1972 KHARIF SEASON, Meteorological Office, Poona (India). C. J. George, and K. S. Ramasastri.
Indian Journal of Meteorology, Hydrology and Geophysics, Vol. 26, No. 1, p 89-96, January 1975. 8 fig, 5 ref.

Descriptors: *Droughts, *Water balance, *Indian Ocean, Climates, Networks, Crop response, Recession curves, Monsoons, Rainfall, Storms, Regional analysis.
Identifiers: *Agricultural droughts, *Kharif season, *India, Aridity index, Crop reports, Drought areas, Southwest monsoons.

The agricultural drought of the 1972 Kharif season was studied by computing weekly water balance of a selected network of stations. Weekly aridity index values above the climatic aridity index was used to identify drought incidence. The study showed that a prolonged drought spell, abating only for short periods, prevailed in the season over large areas of Madhya Maharashtra, Marathwada, Gujarat, Rajasthan, Interior Mysore and Andhra Pradesh. The findings were substantiated by reports in newspapers and crop reports of that period. (Roberts-ISWS)
W76-06681

THE MEASUREMENT AND RECORDING OF RAINFALL INTENSITIES, J. Drabbe.
Weather, Vol. 30, No. 8, p242-247, August 1975. 3 fig.

Descriptors: *Rain gages, *Precipitation gages, *Instrumentation, Equipment, Measurement, Rainfall, Precipitation (Atmospheric), Precipitation intensity, Rainfall intensity, Meteorology.

Rainfall intensity research is useful in recording average as well as phenomenal falls, and correlating them with damage done to roads, pastures, and the general environment. To give a more detailed picture of the intensities it is better to measure the rainfall in small increments of, say, tenths of a millimeter rather than in large increments of, say, a millimeter. With these aims in mind, a completely new type of gage was designed, and built. As small amounts are difficult to measure on a bucket-type instrument, it was decided to pass the water into measuring tubes where they are automatically discharged when the meniscus touches a sensitive probe situated in the top of the tube. Two tubes are then required so as not to impede the flow of water through the system. While one tube is being filled up to its mark, the other is either discharging or has been emptied. The maximum handling capacity of the gage is 200 millimeters of rain per hour when it is measuring in tenths of one millimeter. While greater falls than 200 millimeters per hour are possible in some parts of the world, prolonged falls such as this are rare. (Sims - ISWS)
W76-06692

PRECIPITATION IN VALLEYS, R. W. Longley.
Weather, Vol. 30, No. 9, p 294-300, September 1975. 5 fig, 5 tab, 3 ref.

Descriptors: *Rainfall disposition, *Topography, *Valleys, *Canada, Precipitation (Atmospheric), Orography, Distribution patterns, Climatology, Meteorology.

The effects of hills and mountains on the spatial distribution of rainfall have long been studied, but very little has been written on the effect of a valley on the distribution of rainfall. From the monthly records the monthly totals were abstracted for stations in the prairie provinces of Canada. Ratios were calculated for the precipitation at valley stations as compared to other nearby stations on the plains above the valley. The average ratio was 1.17 for all months and stations combined. For all months, the valley precipitation was always less. The ratio was minimum in July at 1.12, and maximum in December when the ratio was 1.25. (Sims - ISWS)
W76-06693

A SIMPLE RAIN-GAUGE FOR DENSE NETWORK RESEARCH, Newport Grammar School, Essex (England). I. J. Roper.
Weather, Vol. 30, No. 10, p329-336, October 1975. 1 fig, 2 tab, 18 ref.

Descriptors: *Rain gages, *Precipitation gages, *Instrumentation, Equipment, Rainfall, Measurement, Precipitation (Atmospheric), Winds, Correlation analysis, Regression analysis, Meteorology.

Standard Meteorological Office rain-gages are expensive, and often a cheaper acceptable substitute would be desirable, especially for dense network studies and where theft and wanton damage at sites in open agricultural land may have to be met. Such was the case when a dense network of over twenty gages was installed in the 15.4 sq km catchment of the Catchwater Drain, in East Yorkshire. As a substitute for conventional gages, plastic funnels with a 126.6 sq cm orifice (i.e. five-inch diameter), sharpened to a knife edge, were

used in conjunction with ordinary wine bottles. No attempt was made to reproduce the cylindrical shape of the Meteorological Office gage. The M.O. pattern gages have a vertical rim 11.5 cm high to stop out splash, whereas the plastic funnels had a rim only 2.4 cm high; despite this, the latter still caught more rain. The main effect difference in design was the lower wind resistance offered by the plastic funnel gages. Although there was a variation of + or minus 4% in the daily catch, comparing the plastic gages with the standard M.O. gage, such a result could occur purely because of local chance eddies and turbulence. Thus simple plastic funnel gages would appear to offer a reliable substitute for a M.O. gage if cost represents an important consideration when deciding on the number of gages that might be used. (Sims - ISWS) W76-06694

2C. Snow, Ice, and Frost

THE WATER FAUNA OF THE HIGH MOUNTAIN GLACIER LAKES IN THE MANDARAS VALLEY IN THE HIGH HINDU KUSH, (IN POLISH),

Jagellonian Univ., Krakow (Poland). Instytut Zoologii Systematics; and Jagellonian Univ., Krakow (Poland). Instytut Zoogeography. For primary bibliographic entry see Field 5C. W76-06166

MAXIMUM WATER EQUIVALENTS OF SNOW IN THE NORTHWESTERN REGIONS OF THE EUROPEAN USSR,

L. K. Vershinina, and V. N. Volchenko. Soviet Hydrology, Selected Papers, No. 1, p 1-11, 1974. 5 fig, 6 tab, 12 ref. Translated from Trudy Gosudarstvennogo Gidrologicheskogo Instituta, No. 214, p 37-53, 1974.

Descriptors: *Snow, *Water equivalent, *Melt water, *Europe, *Precipitation(Atmospheric), Snowfall, Snow surveys, Runoff, Runoff forecasting, Forests, Snowmelt, Snow cover, Soil moisture, Watersheds(Basins), Temporal distribution. Identifiers: *USSR.

The water equivalent of snow accumulated over the winter is the main factor determining the magnitude of the spring flood runoff in regions deficient in moisture, since soil moisture varies little from year to year. For this reason, it is particularly important to compute the maximum water equivalents and their variations in these regions. Maps were constructed of the distribution of 22-year mean maximum water equivalent and of its variation for the field from data at 146 points. The temporal variations of maximum water equivalent were practically the same in the field and forest. This made it possible to compute the maximum water equivalent of varying probability for entire river basins, using the parameters of the distribution curves obtained for any given type of landscape, i.e., field or forest. Average snow accumulation was 10-20% higher in mixed and deciduous forests than in the field, regardless of the location of the forests in the region under study, while it was lower by 5-10% in predominantly coniferous forests because of the interception of snow by the tree crowns and its subsequent evaporation. The spacial variations of maximum water equivalent in fields and forests in the extreme west (Latvian SSR) and in the northwest (Luga River basin) were determined by the snowiness of the winter. (Sims-ISWS) W76-06172

EXPERIMENT IN APPLYING CORRELATION ANALYSIS TO THE DESCRIPTION OF THE TEMPORAL VARIATIONS OF SNOW MELTING INTENSITY IN THE DON RIVER BASIN,

M. S. Deleu, and V. A. Rumayntsev.

Soviet Hydrology, Selected Papers, No. 1, p 12-16, 1974. 2 fig, 2 ref. Translated from Trudy Gosudarstvennogo Gidrologicheskogo Instituta, No. 214, p 54-60, 1974.

Descriptors: *Snowmelt, *Snow, *Melting, *Temporal distribution, *Correlation analysis, Statistical methods, Snowfall, Melt water, Thawing, Runoff, Timing. Identifiers: *USSR, *Melting rates, *Don River Basin(USSR).

It is important to know the space-time variations of various hydrometeorological characteristics to solve some practical problems and for forecasting purposes. Of particular interest is the snow melting rate, whose behavior in time and space is usually disordered and largely random. For this reason, the variations in melting rate can be described only statistically. Results were reported of a correlation analysis of the temporal variations of the snow melting rate in the Don River basin. A fairly high time correlation between the daily snow melting rates with a shift of 1-2 days was established. The correlation functions were shown to be inhomogeneous for different years. A relation was obtained between the terms of time correlation functions and elevation. It is suggested that a discrete first-order autoregression process be used as a model of the generating process for the snow melting rate. It was found from the model of the autoregression process for the years under study that a linear forecast of the snow melting rate is unsatisfactory, even for a forecast one day in advance. (Sims-ISWS) W76-06173

DETERMINATION OF THE DATES OF SNOW DISAPPEARANCE IN THE FOREST, S. B. Deribizova.

Soviet Hydrology, Selected Papers, No. 1, p 17-22, 1974. 1 fig, 3 tab, 13 ref. Translated from Trudy Gosudarstvennogo Gidrologicheskogo Instituta, No. 214, p 61-69, 1974.

Descriptors: *Snow, *Melting, *Forests, Timing, Temperature, Water equivalent, Precipitation(Atmospheric), Snowfall, Snowmelt, Deciduous forests, Coniferous forests. Identifiers: *USSR.

The dates of the disappearance of the main mass of snow from fields and forests in drainage basins must be known to analyze the conditions of spring flood runoff formation. This makes it possible to estimate the part played by precipitation before and after the disappearance of snow, as well as that of evaporation and other factors in the formation of flood runoff. The station network observes the disappearance of snow only in fields within the visible range of the station surroundings. For this reason, the data on snow disappearance in forests must be determined by computation. The dates of snow disappearance in forests can be reliably computed from snow melting coefficients (mm per degree of positive air temperature) that are constant for each spring and from a typical areal snow distribution curve. In mass computations, the dates of snow disappearance in forests can be determined from the date of occurrence of maximum discharges for rivers with a basin area of 2-10,000 sq km that are more than 60% wooded. The computed dates of snow disappearance make it possible to analyze the conditions of spring flood runoff formation during the melting period and the snowless part of the flood. (Sims-ISWS) W76-06174

MELT-WATER LOSSES THROUGH INFILTRATION INTO PODZOLIC SOILS AND CHERNOZEMES,

For primary bibliographic entry see Field 2G. W76-06181

MEASUREMENT OF SMALL STRAIN-RATES OVER SHORT TIME PERIODS,

Department of the Environment, Ottawa (Ontario). Inland Waters Directorate; and Department of the Environment, Ottawa (Ontario). Glaciology Div. G. Holdsworth. Journal of Glaciology, Vol. 14, No. 71, p 317-324, 1975. 7 fig, 3 ref.

Descriptors: *Instrumentation, *Strain measurement, *Ice, *Strain, *Strain gages, *Glaciers, *Measurement, *Physical properties, *Equipment, *On-site investigations, *Glaciology. Identifiers: *Laser interferometers.

A laser interferometer has been used to measure small relative displacements between two reference points spaced up to 99.76 m apart and fixed in an ice surface. Strain-rates of order 10^{-10} to the minus 11th power/s can be detected easily within a 24 h period and possibly within an 8 h period. Application of this system could be extended to sea or lake ice provided the mounting posts are redesigned. The laser unit operates successfully at air temperatures below 0°C. Under enclosed conditions or in stable air without precipitation, the maximum practical distance between the interferometer and the reflector is about 100 m, with the laser output gain at the highest level. (Sims - ISWS) W76-06184

RAPID PRODUCTION OF SINGLE CRYSTALS OF ICE,

National Physical Research Lab. Pretoria (South Africa). D. v. d. S. Roos. Journal of Glaciology, Vol. 14, No. 71, p 325-328, 1975. 3 fig, 8 ref.

Descriptors: *Ice, *Crystal growth, *Crystals, *Technology, *Laboratories, *Laboratory equipment, *Seeds, *Glaciology. Identifiers: *Laboratory procedures, *Ice crystal growth, *Seed crystals, *Dendrites.

A description was given of how to grow single crystals of ice of desired orientation by applying the method of seed extraction from the melt. A single crystal of more than 1 g can be grown in less than one hour. (Sims-ISWS) W76-06186

ORIENTATION OF SOIL STRIPES CAUSED BY NEEDLE ICE,

British Columbia Univ., Vancouver. Dept. of Geography; and British Columbia Univ., Dept. of Geological Sciences. J. R. Mackay, and W. H. Mathews. Journal of Glaciology, Vol. 14, No. 71, p 329-331, 1975. 1 fig, 9 ref.

Descriptors: *Ice, *Soils, *Thawing, *Melting, *Solar radiation, *Soil water, *Soil moisture. Identifiers: *Needle ice, *Soil stripes.

Orientation of striping caused by needle ice has been ascribed in the past to (1) wind direction during soil freezing, and (2) azimuth of the sun during thawing. Recent evidence supported the latter concept. Needle-ice striped ground can be shown to result as a thaw phenomenon by direct observation, by controlled and natural shading which prevents stripe growth, and by experiments with a heat lamp to cause striping. (Sims-ISWS) W76-06187

SEDIMENTS EXPOSED ON THE SURFACE OF THE ROSS ICE SHELF, ANTARCTICA,

Nebraska Univ., Lincoln. Ross Ice Shelf Project. D. R. Gaylord, and J. D. Robertson. Journal of Glaciology, Vol. 14, No. 71, p 332-333, 1975. 1 fig, 1 ref. NSF GV-4073X, GV-39639.

Field 2—WATER CYCLE

Group 2C—Snow, Ice, and Frost

Descriptors: *Sediments, *Ice cover, *Antarctic, Glaciers, Ice, Sedimentology, Glaciology.
Identifiers: *Ross Ice Shelf (Antarctica), Ice shelves.

A highly crevassed region near a grounded ice rise on the Ross Ice Shelf, Antarctica, was investigated and found to contain poorly sorted sediments. Preliminary analysis of a 27 g sample of sediments was undertaken using megascopic, microscopic, and X-ray diffraction methods. Igneous and metamorphic rock fragments, their constituent minerals, and micro-fossils were noted in the sample. Insufficient data have been collected at this time to denote a particular source area for the sediments. (Sims-ISWS)
W76-06188

CALCULATING TEMPERATURE REGIME OF EARTH DAMS IN PERMAFROST REGIONS, Moskovskii Inzhenerno-Stroitelnyi Institut (USSR). Dept. of Hydraulic Engineering Structures.
For primary bibliographic entry see Field 8D.
W76-06191

THE BEARING CAPACITY OF FLOATING ICE PLATES SUBJECTED TO STATIC OR QUASI-STATIC LOADS, A CRITICAL SURVEY, Princeton Univ., N. J. Dept. of Civil and Geological Engineering.
For primary bibliographic entry see Field 8G.
W76-06192

PREVENTION AND CONTROL OF CULVERT ICING, SUMMARY REPORT ON STUDIES FY 1966-70, Cold Regions Research and Engineering Lab., Hanover, N. H. Experimental Engineering Div.
For primary bibliographic entry see Field 8A.
W76-06193

SNOW AVALANCHE HAZARD IN THE UNITED STATES: A RESEARCH ASSESSMENT, Colorado Univ., Boulder, Inst. of Behavioral Science.
Available from the National Technical Information Service, Springfield, Va 22161, as PB-242 980, \$5.50 in paper copy, \$2.25 in microfiche. Monograph NSF-RA-E-75-017, 1975. 86 p, 13 fig, 10 tab, 34 ref. NSF GI-32942.

Descriptors: *Avalanches, *Snow, *Snow management, Snowpacks, Hazards, Safety, Control, Snow cover, Snow cornice, Winter sports, Skiing, Damages, Explosions, Forests, Mountains, Construction, Structures, *Research priorities, Evaluation.

In recent years, research to find effective ways of dealing with avalanche hazards has intensified. In spite of these efforts, the risk to population and property continues to increase in harmony with the movement of population to mountain recreation areas of the western United States. With greater risk should come increasing support to research aimed at alleviating the hazard to people and property. Construction of control works is limited by the availability of suitable sites and by environmental costs. Among the various adjustments, control and protection can be undertaken with the greatest confidence that the anticipated reduction in risk will be achieved either by more reliable techniques or by more efficient application. More reliable avalanche warning would have the obvious benefits of reduced risk and loss, especially in the case of short-term warnings of potential occurrences along highways and in ski areas. If avalanche risk zones can be adequately identified, land use regulations can be created which will require that development be commensurate with the level of risk. Such regulations should lead to loss reduction in the long run; for this risk mapping is essential. (Sims-ISWS)

W76-06195

BEHAVIOUR OF OIL UNDER CANADIAN CLIMATIC CONDITIONS PART 1. OIL ON WATER UNDER ICE-FORMING CONDITIONS, Department of the Environment, Ottawa (Ontario). Inland Waters Directorate; and Department of the Environment, Ottawa (Ontario). Water Quality Branch.
For primary bibliographic entry see Field 5G.
W76-06366

FLOOD OF JUNE 1971 FORT NELSON AND MUSKWA RIVERS, Department of the Environment, Vancouver (British Columbia). Inland Waters Directorate (Pacific Region); and Department of the Environment, Vancouver (British Columbia). Water Resources Branch.
For primary bibliographic entry see Field 2E.
W76-06367

RESEARCH PROJECTS IN GLACIOLOGY - 1974, Department of the Environment, Ottawa (Ontario). Inland Waters Directorate; and Department of the Environment, Ottawa (Ontario). Water Resources Branch.
Report Series No. 36, 1974, 123 p, 17 photos, 133 ref.

Descriptors: *Glaciology, *Research facilities, *Arctic, *Hydrology, Remote sensing, Mapping, Instrumentation, Ice cover, Avalanches, Glaciers, Bibliographies, Snow cover, Cryogenics, Crystallography, Permafrost, Microwaves, Drilling, Gamma rays, Pipelines, Electrical properties, Ice jams.
Identifiers: Northwest territories, Mackenzie Valley, Ice properties, Floating ice, Ice-breaking, Glacier mapping.

The glaciological research program of the Water Resources Branch of the Department of the Environment is outlined. The objectives and organization of the group are summarized and a catalog of individual research projects is included. Project descriptions include the name of the investigator, the objectives of the research, the location of the research, the work underway, and the future program. Publications by members of the Glaciology Division are listed. (Environment Canada)
W76-06368

DETERMINATION OF SNOW DEPTH AND SNOW EXTENT FROM NOAA 2 SATELLITE VERY HIGH RESOLUTION RADIOMETER DATA, National Environmental Satellite Service, Washington, D.C.
D. F. McGinnis, Jr., J. A. Pritchard, and D. R. Wiesnet.
Water Resources Research, Vol. 11, No. 6, p 897-902, December 1975. 6 fig, 5 ref.

Descriptors: *Satellites (Artificial), *Snow, *Snow cover, *Remote sensing, Reflectance, Regression analysis, Precipitation (Atmospheric), Snowpacks, Data processing.
Identifiers: *Snow depth, Brightness, Very high resolution radiometer.

The NOAA 2 environmental satellite and subsequent environmental satellites provide daily coverage of the earth in the visible (0.6-0.7 micrometer) and thermal (10.5-12.5 micrometer) spectral bands. The ground resolution of the very high resolution radiometer is 1 km at nadir. This improved resolution in the visible spectral band permits more detailed observations of snow features than were possible with the previous operational satellites. A visible band image from February 11, 1973, depicted the heavy snow cover

in considerable detail in areas from Alabama to North Carolina. Digitized reflectance data from the study area were compared with prestorm bare ground digitized reflectance data of February 6, 1973, to examine the relation of snow reflectivity to snow depths. A regression analysis of greatest brightness versus greatest snow depth for 201 data pairs produced a power correlation coefficient of 0.86. Reflectance values from snow deeper than 30 cm tended to be uniformly high; values from snow less than 30 cm tended to increase rapidly as snow depth increased. (Jones - ISWS)
W76-06383

METHOD FOR COMPUTING EVAPORATION DURING THE SNOW MELTING AND FLOOD PERIOD IN THE CENTRAL CHERNOZEM REGIONS OF THE EUROPEAN USSR,
For primary bibliographic entry see Field 2D.
W76-06407

A METHOD FOR ESTIMATING SNOWFALL AMOUNTS, Oregon State Univ., Corvallis. Dept. of Forest Engineering.
R. L. Beschta.
Water Resources Bulletin, Vol. 11, No. 6, p 1209-1219, December 1975. 5 fig, 3 tab, 17 ref.

Descriptors: *Snowfall, *Estimating, *Snow, *Statistical methods, Temperature, Precipitation (Atmospheric), Climatic data, Regression analysis, Snow cover, Geomorphology.
Identifiers: *Snowfall index, Snow density, Snow load, Snow accumulation, Scatter diagrams.

Long-term climatic data from National Weather Service stations in six areas of the United States were utilized to develop regression equations relating a 'snowfall index' parameter and air temperature. Nearly 200 stations, representing a wide range in physiographic and climatic conditions, were selected for analysis. Snowfall index was defined as the ratio of snowfall depth to precipitation. Using annual data, regression analysis indicated snowfall index to be significantly ($\alpha=0.01$) related to temperature for five of the six areas studied. Differences between equations were attributed to the effects of precipitation and temperature during non-snowfall periods. Mean monthly data were also considered and significant equations ($\alpha=0.01$), representing a family of similarly shaped curves, were obtained. The illustrated equations can be used for estimating mean monthly and annual snowfall amounts for stations having only temperature and precipitation measurements. (Jones-ISWS)
W76-06408

PRELIMINARY HYDROGRAPHY AND HISTORIC TERMINAL CHANGES OF COLUMBIA GLACIER, ALASKA, Geological Survey, Tacoma, Wash.
For primary bibliographic entry see Field 7C.
W76-06449

DEVELOPMENT OF METHODOLOGY FOR EVALUATION AND PREDICTION OF AVALANCHE HAZARD IN THE SAN JUAN MOUNTAIN AREA OF SOUTHWESTERN COLORADO, Colorado Univ., Boulder. Inst. of Arctic and Alpine Research.
R. L. Armstrong, E. R. LaChapelle, M. J. Bovis, and J. D. Ives.
Report INSTAAR-14-06-7155-3, December 1974, 141 p. 14-06-D-7155

Descriptors: *Avalanches, *Forecasting, Snow, Snowpacks, Precipitation (Atmospheric), Hazards, Precipitation rate, Monitoring, *Colorado, *Methodology.
Identifiers: Snow formation, *San Juan Mountains (Colo).

Avalanche initiation is under study by analyzing the complex relationships among terrain, climate, and snow stratigraphy. Air and snowpack temperatures, wind speed and direction, precipitation rate and amount, snow settlement rate, net all-wave radiation at the snow surface, and snow density and water equivalent values are measured at the prime study site at Red Mountain Pass (3400 m). Climatological data are also collected routinely in Silverton (2830 m) and at the Rainbow site (3490 m) adjacent to the starting zones of the Brooklyns avalanche paths. Avalanche events are monitored by direct observation and by trip wires on selected paths. During the third winter, emphasis was placed on the development of the snow stratigraphy; abundant snow pit data were acquired from standard level snow study sites, from test slopes similar to avalanche release zones, and from avalanche fracture lines. Avalanche hazard forecasts based on weather and snowpack conditions were made daily. In addition, work began on a statistical model to forecast avalanche occurrence. (Bureau of Reclamation)
W76-06605

HYDROLOGICAL FORECASTING PRACTICES.

World Meteorological Organization, Geneva (Switzerland). Working Group on Hydrological Forecasting.
For primary bibliographic entry see Field 2A.
W76-06633

SEASONAL STREAMFLOW ESTIMATION EMPLOYING SATELLITE SNOWCOVER OBSERVATIONS.

National Aeronautics and Space Administration, Greenbelt, Md. Goddard Space Flight Center.
For primary bibliographic entry see Field 4A.
W76-06638

OPERATIONAL ICE FORECAST FOR THE LITTLE RAPIDS CUT.

National Oceanic and Atmospheric Administration, Ann Arbor, Mich. Great Lakes Environmental Research Lab.
J. C. Rogers, B. DeWitt, and D. Dixon.
Technical memo. ERL GLERL-4, GLERL Contribution No. 46, November 1975. 17 p, 2 fig, 3 tab, 2 ref, 4 append.

Descriptors: *Ice, *Ice cover, *Climatology, Weather forecasting, Future planning(Projected), Meteorology, Hydrology, Meteorological data, Hydrologic data, Air temperature, Great Lakes Region, *Michigan, Forecasting.
Identifiers: *Ice forecast, *Forecast procedures, Little Rapids Cut(Mich), St. Mary's River(Mich).

An operational 5-day forecast procedure is presented for predicting the initial date of ice-related problems at the Little Rapids Cut and the continuing degree of difficulty the Sugar Island Ferry would experience in crossing the St. Marys River at that point. The forecast procedures were developed by use of meteorological and hydrological data, aerial photographs of ice cover, and time lapse films of the motion of jammed ice toward the Sugar Island ferry crossing. Ice problems had generally begun within 10 days after the water temperature in the river had reached 32F. Once ice problems began, the degree of difficulty in crossing the river, expressed in three probability categories, was forecast daily, based upon air temperatures, upstream ice cover, and shipping activity. Results of the operational-experimental forecast of the onset date of problems during the 1974-75 winter are presented. With the continuation of shipping and accumulation of over 850 freezing degree-days, the Sugar Island ferry was often not able to cross the river without ice-breaker assistance. (NOAA)
W76-06658

DEVELOPMENT OF SNOW WATER EQUIVALENT SURVEY METHODS USING AIRBORNE GAMMA MEASUREMENTS.

EG and G, Inc., Las Vegas, Nev.
A. Fritzsche, and C. Juniper.
Report No. EGG-1183-1677, 24 p, 3 fig, 2 tab, Nov 1975. EGG-1183-1677, No. E(29-11-1183).

Descriptors: *Surveys, *Snow surveys, *Hydrologic data, *Measurements, Hydrology, Snow, Snowmelt, Water equivalent, Soil moisture, *Remote sensing.
Identifiers: *Gamma measurements, *Airborne gamma measurements, Snow water, Snow water equivalent, Soil moisture surveys.

A summary is presented of the progress made during the period March 1975 through September 1975 on EG and G's support of NOAA for development of airborne techniques for measurement of the water equivalent of snow and soil moisture. The work included a series of snow and soil moisture surveys and development of a new detector and data acquisition system. Plans for the immediate future are reviewed. In addition, suggestions for other future work are discussed and recommendations made. (NOAA)
W76-06659

SNOW WATER EQUIVALENT SURVEYS OF THE SOURIS RIVER BASIN.

EG and G, Inc., Las Vegas, Nev.
A. E. Fritzsche, and E. L. Feimster.
Rpt. No. EGG-1183-1668, November 1975. 44 p, 1 fig, 10 tab, 8 ref, 4 append. E(29-11-1183).

Descriptors: *Water measurement, *Snow, *Snow surveys, *Water equivalent, Snowmelt, Hydrologic data, Hydrology, Canada, North Dakota.
Identifiers: Snow water, Snow water equivalent, *Snow water equivalent surveys, Gamma fluence, Bare ground surveys, *Souris River Basin(N Dak-Can).

Three airborne surveys, employing the measurement of the natural terrestrial gamma radiation to determine the water equivalent of snow cover, were conducted over the Souris River Basin in Saskatchewan, Canada, and North Dakota, in the fall and winter of 1974-75. This airborne survey method used the attenuation of the natural terrestrial gamma fluence rate (flux) to measure the water equivalent of snow on the earth's surface. Twenty-three survey lines (12 in North Dakota and 11 in Saskatchewan) were chosen as adequate coverage of the Souris River Basin. Snow water equivalent results are reported for each of the 23 sub-basins. (NOAA)
W76-06665

ICE PARTICLE MULTIPLICATION IN CUMULUS CLOUDS.

Manchester Univ. (England). Dept. of Mathematics.
For primary bibliographic entry see Field 2B.
W76-06678

2D. Evaporation and Transpiration

EFFECTS OF WATER STRESS ON LEAF RESPIRATION, TRANSPIRATION RATES IN THE DARK AND CUTICULAR RESISTANCE TO WATER VAPOR DIFFUSION OF TWO CORN INBREDS.

Laval Univ., Dept. of Phytotechnique, Quebec.
P. A. Dube, K. R. Stevenson, G. W. Thurtell, and R. B. Hunter.
Canadian Journal of Plant Science, Vol. 55, p 565-572, April, 1975. 4 fig, 1 tab, 24 ref.

Descriptors: *Moisture stress, *Plant physiology, *Transpiration, *Respiration, *Corn(Field), Plant growth, Drought tolerance, Moisture tension, Osmotic pressure, Water requirements, Plant tis-

sues, Leaves, Stomata, Water vapor, Crop production.
Identifiers: *Cuticular resistance, Water vapor diffusion, Zea mays L. Q188, Zea mays L. DR1, Dark transpiration.

Growth chamber studies on 2 lines of corn (Zea mays L.), a wilting inbred line (Q188) and an inbred line known to have at least some heat and drought tolerance (DR1), indicated differences in dark transpiration and the magnitude of cuticular resistances to water vapor diffusion. Q188 had greater dark transpiration than DR1 and both showed decreased transpiration as leaf water potentials decreased. Cuticular resistance to water vapor diffusion was initially higher in DR1 and increased at a faster rate than in Q188 as the drying cycle progressed. Incomplete recovery in leaf water potential was observed in both lines upon watering after severe desiccation. No differences were found in leaf respiration rates between the inbreds. (Robnett-Arizona)
W76-06266

WATER USE, ENERGY BALANCE AND GROWTH OF MAIZE AT SAMARU, NORTHERN NIGERIA.

Institute for Agricultural Research, Zaria (Nigeria).
For primary bibliographic entry see Field 3F.
W76-06298

CHANGES IN CLIMATE AND ESTIMATED EVAPORATION ACROSS A LARGE IRRIGATED AREA IN IDAHO.

Wyoming Univ., Laramie. Dept. of Agricultural Engineering.
R. D. Burman, J. L. Wright, and M. E. Jensen.
Transactions of the American Society of Agricultural Engineers, Vol. 18, No. 6, p 1089-1093, November-December 1975. 7 fig, 3 tab, 16 ref.

Descriptors: *Evaporation, *Irrigation, *Climates, *Idaho, Estimating, Advection, Crops, Irrigated land, Evapotranspiration, Temperature, Precipitation(Atmospheric), Sagebrush, Winds, Humidity, Diurnal, Vapor pressure, Wind velocity, Climatology.
Identifiers: *Climatic change, *Estimated evaporation, Irrigated crops, Climatological study, Hygrothermographs, Steppe climate.

Ground level climatic measurements were taken along a 50 km transect going from dry sagebrush land into the center of a large irrigated area in southern Idaho. Measurements in May, when the desert area was dry, indicated that climatic changes across the transect were minimal. In August, when the desert was obviously very dry, air temperatures decreased, vapor pressure increased, and windspeed was reduced about 40% within the irrigated area. The results demonstrated that any weather service agency or group must consider the distance from dry surroundings when selecting sites that are to be representative of climatic conditions over irrigated fields. (Roberts-ISWS)
W76-06406

METHOD FOR COMPUTING EVAPORATION DURING THE SNOW MELTING AND FLOOD PERIOD IN THE CENTRAL CHERNOZEM REGIONS OF THE EUROPEAN USSR.

A. N. Postnikov.
Soviet Hydrology, Selected Papers, No. 1, p 23-31, 1974. 2 fig, 9 tab, 8 ref. Translated from State Hydrologic Institute (Trudy GGI), No. 214, p 70-83, 1974.

Descriptors: *Evaporation, *Snowmelt, Soils, Flood peak, Moisture, Spring, Evaporimeters, Precipitation(Atmospheric), Soil horizons, Probability, Radiation, Grasslands, Forests.
Identifiers: *Central Chernozem regions, *Flood period, *European USSR, *USSR, Forest-steppe, Forest zone, Spring flood.

Field 2—WATER CYCLE

Group 2D—Evaporation and Transpiration

Evaporation is fairly high during the spring flood period in the forest-steppe and forest zones of European USSR. It amounts to 10-70% of the sum of water equivalent and precipitation in certain years. Evaporation from the surface of drainage basins must be taken into account in hydrologic budget studies and in the analysis and computation of spring flood runoff. Since it is difficult to measure evaporation directly in spring, and at only a few limited places, it becomes necessary to develop simple methods for computing evaporation from meteorological data. An attempt was made to establish a relation between evaporation during the spring flood period and the total air moisture deficit over this period. Observations were made with evaporimeters evenly distributed over the Don River basin. They were filled when snow started melting, weighed every 5 days, and refilled every 10 days. It was concluded that during the spring flood period, the upper soil layers had a moisture content close to or exceeding minimum moisture capacity after the disappearance of snow. It was also concluded that evaporation from basin surfaces during snow melting may be computed by the formula: $E = 0.44 \Sigma d$, where d is the daily moisture deficit in mb. During the remainder of the spring flood period the formula is: $E = 1.1(\Sigma d) 0.82$. (Roberts-ISWS) W76-06407

FACTORS ALTERING THE MICROCLIMATE IN CARLSBAD CAVERNS, NEW MEXICO, Geological Survey, Albuquerque, N. Mex. J. S. McLean. Open-file report 76-171, February 1976. 56 p, 33 fig, 4 tab, 10 ref.

Descriptors: *Evaporation, *Caves, *Karst Hydrology, *New Mexico, *Data collections, Monitoring, Temperature, Humidity, Carbon dioxide, Air, Evaporation pans, Water levels, Underground streams, Lighting, Least squares method, Equations, Evaluation. Identifiers: *Carlsbad Caverns(N Mex).

In 1968, the U.S. Geological Survey began a cooperative program with the National Park Service to study the microclimate in Carlsbad Caverns, N. Mex., to determine ways of reducing excess evaporation from the cave pools and restoring the cave microclimate to more nearly natural conditions. Revolving doors installed during the summer of 1972 at the bottom of the elevator shaft reduced airflow up the elevator shaft which in turn reduced the net evaporation in the cave at least 10 percent. Evaporation pans near the elevator shaft showed a 34 percent average decrease in the annual evaporation rate. Annual evaporation at most locations remote from the elevator shaft increased an average of 23 percent. It is assumed that the increase in evaporation in remote areas of the cave is caused by the heat output resulting from energy consumption for lighting. An analysis using least-squares equations indicated that part of the evaporation at four of the nine evaporation pans can be correlated with energy consumption and may represent an average of 23 percent of total evaporation at these locations. (Woodard-USGS) W76-06452

USING EVAPORATION VALUES FROM EVAPORATION PANS TO ESTIMATE THE WATER CONSUMPTION OF AGRICULTURAL PLANTS AS THE BASIS OF SPRINKLER IRRIGATION CONTROL, (IN GERMAN), W. Schaefer, and R. Koitzsch. Arch Ackerpflanzbau Bodenkd 19(5); p 365-374, 1975.

Descriptors: *Evaporation, *Evapotranspiration, Water consumption, Sprinkler irrigation, Wheat, Potatoes, Sugar beets, Corn(Field), Transpiration.

Evaporation of a free water surface and evapotranspiration of a plant stand sufficiently

supplied with water are governed by similar physical processes. The values of potential evaporation (evaporation in pans) may be used for controlling sprinkler irrigation. During the dry seasons of 1971 and 1973, early potatoes, green maize, spring wheat and sugar beet produced the same yield increase with sprinkling control on the basis of pan evaporation values and with control by the estimation method according to Klatt.--Copyright 1975, Biological Abstracts, Inc. W76-06729

ESTIMATION OF THE TOTAL EVAPORATION OF EXPERIMENTAL OBJECTS IN CLIMATIC CHAMBERS, (IN BULGARIAN), Academy of Agricultural Sciences, Sofia (Bulgaria). Central Lab. for Agrophysical Investigations. M. Petkova-Kilifarska. Fiziol Rast (Sofia) 1 (2), p 93-102, 1974.

Descriptors: *Evaporation, *Moisture, Energy, Transpiration, Estimating, *Heat balance, *Leaves. Identifiers: Climatic chambers, Evaporation.

To evaluate the heat and moisture exchange between plant leaves and the surrounding atmosphere, the dependences which are applied for the theory of heat and mass exchange were used. Methods are discussed for estimating the energy used in the total transpiration of the experimental objects in climatic chambers. Data obtained in this manner later make possible a more correct estimation of the total heat balance of these chambers.--Copyright 1975, Biological Abstracts, Inc. W76-06766

PHYSICAL STUDY OF EVAPOTRANSPIRATION IN NATURAL CONDITIONS: I. ENERGY BALANCE OF NATURAL SURFACES AND EVAPORATION, (IN FRENCH), Institut National de la Recherche Agronomique, Versailles (France). Station Bioclimatologie. A. Perrier. Ann Agron (Paris) 25(1); p 1-18, 1975.

Descriptors: *Evapotranspiration, Energy budgets, *Evaporation, Surfaces.

According to the classical relationships describing transfer and energy balance, actual evaporation and potential evaporation are analyzed functions of 4 kinds of parameters. Some basic assumptions and links are discussed. W76-06784

EVAPORATIVE COOLING OF 'DELICIOUS' APPLES: THE ECONOMIC FEASIBILITY OF REDUCING ENVIRONMENTAL HEAT STRESS, North Carolina State Univ., Raleigh. Dept. of Horticultural Science. For primary bibliographic entry see Field 3F. W76-06791

2E. Streamflow and Runoff

ROLE OF BOGS IN THE FORMATION OF SPRING FLOOD RUNOFF LOSSES IN THE DRAINAGE BASINS OF THE NORTHWESTERN EUROPEAN USSR, For primary bibliographic entry see Field 4A. W76-06175

FORMATION OF WATER AND SEDIMENT DISCHARGE DURING THE SPRING FLOOD ON A SLOPE AND IN A SMALL GULLY-RAVINE DRAINAGE BASIN, For primary bibliographic entry see Field 2J. W76-06176

SEDIMENT RESERVOIRS IN THE CHANNELS OF SMALL MOUNTAIN RIVERS, For primary bibliographic entry see Field 2J. W76-06177

SOME CHARACTERISTICS OF THE PROCESS OF INCOMPLETE MEANDERING OF THE CHANNEL OF THE UPPER OB' RIVER, For primary bibliographic entry see Field 4A. W76-06178

MEASUREMENT OF THE STRUCTURE OF RIVER FLOW, Akademiya Nauk SSSR, Moscow. Institut Vodnykh Problem. B. A. Fidman, A. S. Orlov, and V. S. Morozhenkov. Soviet Hydrology, Selected Papers, No. 6, p 551-560, 1973. 8 fig, 10 ref. Translated from (Water Resources) Vodnyye resursy, No. 6, p 107-117, 1973.

Descriptors: *Flow, *Streamflow, *Rivers, *Model studies, Mathematical models, Measurement, *Turbulence, Velocity, Instrumentation, Profiles, Flow profiles, Hydrology. Identifiers: Velocity pulsations.

An analysis of the method of measuring river turbulence and the results obtained showed that the developed equipment is suitable for field investigations of flow characteristics, determined by the large-scale component of longitudinal velocity. The proposed relations permitted estimating the error and selecting optimum measurement conditions. The results of the measurements confirmed the presence of a standard deviation profile of longitudinal pulsations, referred to dynamic velocity, close to the universal profile, but gave no reason to believe that disturbances of a scale exceeding depth exist in the structure. (Sims - ISWS) W76-06180

PRODUCTION CONDITIONS IN TROUT BROOKS OF BESKID MOUNTAINS: RESULTS OF RESEARCH CARRIED OUT WITHIN THE FRAMEWORK OF THE I.B.P. IN THE YEARS 1966 TO 1971, Brno Univ. (Czechoslovakia). Hydrobiologicka Laborator. J. Helan, F. Kubicek, B. Losos, E. Sedlak, and M. Zelinka. Folia Fac Sci Nat Univ Purkynianae Brun Biol. 14(4): 1-103. Illus. 1973.

Descriptors: *Periphyton, *Zoobenthos, Diatoms, Algae Chlorophyll, *Analysis, Fish populations, Trout, Brook trout, Europe. Identifiers: Beskid Mts., Czechoslovakia.

Collections from trout brooks in the Beskid Mountains, Czechoslovakia included 29 spp. from the periphyton and 138 spp. from the zoobenthos. The species composition of natural and artificial substrata was similar and was predominantly of diatoms. Significant correlations between abundance of algae quantity of organic matter and quantity of chlorophyll A, were found. Average gross primary production of the artificial substratum was 60.3 mg O₂/m²/h. Development of periphyton was influenced by discharge rates of water and local light conditions. Insect groups comprising the zoobenthos were assessed in terms of numbers, weight and production. Changes in discharge rates, speed of streaming, temperature and conversion from pools to torrential zones, influenced distribution of the fauna. Different fishstocks did not appear to affect composition of the zoobenthos. Furthermore, excessive fishstock did not substantially effect its quantity and composition.--Copyright 1975, Biological Abstracts, Inc. W76-06241

WATER CYCLE—Field 2

Streamflow and Runoff—Group 2E

A PRE-IMPOUNDMENT STUDY OF THE FISH FAUNA OF INDIAN CREEK, DEKALB COUNTY, ILLINOIS, Washington Univ., Seattle. Fisheries Research Inst.

A. W. Drew, and D. M. Wildrick.
Trans Ill State Acad Sci. 67(1), p 68-73, 1974.

Descriptors: *Pre-impoundment, Fish, Distribution, Illinois, *Fish populations, Rotenone.
Identifiers: Cyprinid, Dekalb(Ill), Diversity, *Indian Creek(Ill).

A pre-impoundment study of the fish fauna of Indian Creek (Illinois, USA) was conducted to determine both species composition and distribution patterns. Diversity indices are presented for collection stations. Increased diversity was found at stations having increased water depth. Two headwater cyprinid species are apparently replaced downstream by 3 other minnow species. The possible consequences of poisoning Indian Creek with rotenone are discussed.—Copyright 1975, Biological Abstracts, Inc.
W76-06251

DEPOSITIONAL MODELS AND THE SHINARUMP MEMBER AND THE SONSELA SANDSTONE BED OF THE CHINLE FORMATION NORTHEASTERN ARIZONA AND NORTHWESTERN NEW MEXICO, Arizona Univ., Tucson. Dept. of Geosciences.
For primary bibliographic entry see Field 2J.
W76-06258

FLOOD PLAIN MAPPING, Hydrocomp, Inc., Palo Alto, Calif.
R. K. Linsley.
Simulation Network Newsletter, Vol. 7, No. 4, p 1-8, May 15, 1975. 5 fig, 1 tab, 10 ref.

Descriptors: *Simulation analysis, *Flood forecasting, *Hydrology, Rainfall, Data collections, Model studies, Watershed management, Streamflow forecasting, Computers.

In order to set premiums for flood insurance, continuous simulation computer models are specifying the various levels of probability of flooding. Conventional hydrology in flood plain mapping has the problems of limited data, inadequacy of the design rainfall approach, and limitations from assumptions and simplifications. Continuous simulation transforms a long series of rainfall data into streamflow by algorithm representing the hydrologic processes. With sufficient rainfall data, the output is continuous without assuming any specific design rainfall. Probability analysis of this data defines flood levels throughout the watershed without invoking the assumptions inherent in use of backwater methods. The Hydrocomp Simulation Program is adapted to a particular watershed by adjusting parameters such as overland flow slope and length, extent of vegetative cover, and stream pattern in the watershed and area. For ungaged watersheds the parameters are estimated from adjacent gaged watersheds. Where conditions within the watershed vary substantially, it is subdivided into segments with a separate set of parameters for each segment. The data analysis is obtained from the National Weather Service and the U.S. Geological Survey. (Loustau-FIRL)
W76-06312

DISTRIBUTION FUNCTIONS LIMITED AT THE ORIGIN (IM URSPRUNG BEGRENZTE VERTEILUNGSFUNKTIONEN),
For primary bibliographic entry see Field 2A.
W76-06316

THE BLACK HILLS (SOUTH DAKOTA) FLOOD OF JUNE 1972: IMPACTS AND IMPLICATIONS, Forest Service (USDA), Fort Collins, Colo. Rocky Mountain Forest and Range Experiment Station.

H. K. Orr.
General Technical Report RM-2, March 1973. 12 p. 17 fig, 4 tab, 4 ref.

Descriptors: *Historic flood, *Flood damage, *Hydrologic aspects, *Excessive precipitation, Flash floods, Flood disasters, *South Dakota.
Identifiers: *Black Hills(S Dak), Hydrologic conditions, Record rainfall.

Rains of 12 inches or more in 6 hours fell on the east slopes of the Black Hills the night of June 9, 1972. Resulting flash floods exacted a disastrous toll in human life and property. Rainfall and discharge so greatly exceeded previous records that recurrence intervals have been presented in terms of multiples of the estimated 50- or 100-year event. Quick runoff was produced in the heaviest rainfall areas regardless of hydrologic condition. Flood sources included all major geologic and soil types and practically all land uses in the Black Hills. The highest measured peak runoff per unit area came from a 7-square-mile drainage, all of sedimentary formations, the upper portion of which burned over in 1936, but which is now well vegetated, apparently stable, and in good hydrologic condition. Greatest damage occurred where man-origin debris piled up against bridges, highways, homes, and other improvements. (Forest Service)
W76-06360

FLOOD OF JUNE 1971 FORT NELSON AND MUSKWA RIVERS, Department of the Environment, Vancouver (British Columbia). Inland Waters Directorate (Pacific Region); and Department of the Environment, Vancouver (British Columbia). Water Resources Branch.
A. G. Smith.
Technical Bulletin No. 85, 1975, 49p, 33 fig, 18 ref, append.

Descriptors: *Floods, *Snow, *Precipitation(Atmospheric), Geology, Analysis, Investigations, Snowmelt, Washouts, *Alaska, Flow rates.
Identifiers: *Fort Nelson River, *Muskwa River, Alaska Highway.

On June 16, 1971, runoff from heavy precipitation, combined with river channels already bankfull from snowmelt runoff, produced floods in the Muskwa River and Fort Nelson River Valleys of northern British Columbia. The instantaneous maximum flow of the Fort Nelson River near the Town of Fort Nelson has been estimated at 234,000 cfs, the largest flow since records began in 1961. The instantaneous maximum flow of the Muskwa River near Fort Nelson has been estimated at 165,000 cfs, the largest flow since records began in 1944. (Environment Canada)
W76-06367

SURFACE WATER DATA, REFERENCE INDEX, CANADA 1975, Canada Centre for Inland Waters, Burlington (Ontario); and Department of the Environment, Ottawa (Ontario). Water Resources Branch.
For primary bibliographic entry see Field 7C.
W76-06377

FLOOD DAMAGE REDUCTION POTENTIAL OF RIVER FORECAST, Wisconsin Univ., Green Bay. Coll. of Environmental Science.
For primary bibliographic entry see Field 6F.
W76-06435

FLOOD-PRONE AREAS OF GADSDEN COUNTY, FLORIDA, Geological Survey, Tallahassee, Fla.
For primary bibliographic entry see Field 7C.
W76-06443

RAINFALL-RUNOFF DATA FROM SMALL WATERSHEDS IN COLORADO, OCTOBER 1971 THROUGH SEPTEMBER 1974, Geological Survey, Denver, Colo.
For primary bibliographic entry see Field 7C.
W76-06446

HYDROLOGICAL FORECASTING PRACTICES, World Meteorological Organization, Geneva (Switzerland). Working Group on Hydrological Forecasting.
For primary bibliographic entry see Field 2A.
W76-06633

A GENERALIZED STREAMFLOW SIMULATION SYSTEM, CONCEPTUAL MODELING FOR DIGITAL COMPUTERS, National Weather Service, Sacramento, Calif. River Forecast Center.
For primary bibliographic entry see Field 2A.
W76-06634

SEASONAL STREAMFLOW ESTIMATION EMPLOYING SATELLITE SNOWCOVER OBSERVATIONS, National Aeronautics and Space Administration, Greenbelt, Md. Goddard Space Flight Center.
For primary bibliographic entry see Field 4A.
W76-06638

USE OF RADAR INFORMATION IN DETERMINING FLASH FLOOD POTENTIAL, National Weather Service, Garden City, N.Y. Eastern Region.
For primary bibliographic entry see Field 4A.
W76-06653

SYNTHESIS OF BASIN RESPONSE WITH INADEQUATE DATA, Osmania Univ., Warangal (India). Regional Engineering Coll.
For primary bibliographic entry see Field 2A.
W76-06675

METHOD FOR REDUCING SINGLE DISCHARGE MEASUREMENTS TO THE AVERAGE DISCHARGE OF THE LOW-FLOW PERIOD, B. L. Sokolov.
Soviet Hydrology, Selected Papers, No. 4, p 235-241, 1974. 5 fig, 1 tab, 6 ref. Translated from Transactions of the State Hydrological Institute (Trudy GGI), No. 213, p 171-181, 1974.

Descriptors: *Discharge(Water), *Base flow, *Streamflow, Data processing, Hydrogeology, Groundwater movement, Flow, Rivers, Streams, Hydrology.

Using conversion factors, single discharge measurements were reduced to the average discharge over periods when a river is fed only by groundwaters. The values of the conversion factors K are computed from the data of permanent gaging stations of the Hydrometeorological Service as the quotient of the division of the average discharge (discharge rate) over the low-flow period by the measured discharge. Several permanent observation stations were used as analog gaging stations on the principle of similarity of physiographic conditions, i.e., hydrogeological structure, drainage area, woodedness, waterlogging, etc. The arithmetic mean of the factor K, determined from several analog gaging stations (usually 2-3), was used as the final value. This proposed method is more justified for the Omega-Northern Dvina interfluvium than the available methods because it allows for the effect of physiographic conditions on the patterns of variation of conversion factors and also because this factor is assigned on the basis of virtually all information on the water regime dur-

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ing the summer-autumn period. This makes it unnecessary to search in each specific case for suitable analogs, which are selected on the basis of qualitative considerations of similarity of natural conditions in the basins and frequently mechanistically from the agreement between conversion factors. (Sims-ISWS)
W76-06679

THE BED-LOAD FUNCTION,
Research Council of Alberta, Edmonton. Highway and River Engineering Div.
For primary bibliographic entry see Field 2J.
W76-06683

THE STREAM AND ITS VALLEY,
For primary bibliographic entry see Field 2A.
W76-06722

LIMNOLOGICAL AND MORPHOLOGICAL RELATIONSHIPS BETWEEN WATER AND RIVER BED IN THE LOWER COURSE OF THE THUR RIVER, (IN GERMAN),
B. Moergeli.
Vierteljahrsschr Naturforsch Ges Zuer 119(1), p 23-124, 1974.

Descriptors: Rivers, *River beds, *Limnology, Channel morphology.
Identifiers: *Switzerland River thur.

Between Oct. 1969 - Dec. 1971, limnological and morphological investigations on the River Thur and its tributaries between Frauenfeld and Flaach were carried out. The object was to thoroughly explore the processes between the water and the river bed on a river in Eastern Switzerland.—Copyright 1975, Biological Abstracts, Inc.
W76-06736

A NATURAL HISTORY STUDY OF THE VASCULAR FLORA OF CEDAR BOG, CHAMPAIGN COUNTS, OHIO,
Urbana Coll., Ohio. Div. of Scientific Mathematics.
For primary bibliographic entry see Field 2H.
W76-06760

2F. Groundwater

KANSAS GROUNDWATER POLICY SEMINAR,
Kansas Water Resources Research Inst., Manhattan.
For primary bibliographic entry see Field 4B.
W76-06154

DRAINAGE RATES FROM A VERTICAL COLUMN,
Colorado State Univ., Fort Collins.
H. J. Morel-Seytoux.
Hydrological Sciences Bulletin, Vol. 20, No. 2, p 249-255, June 1975. 2 fig, 3 ref. OWRT B-070-COLO (16), 14-31-0001-3566.

Descriptors: *Drainage, *Infiltration, *Model studies, *Equations, Infiltration rates, Rates, Recharge, Percolation, Drainage effects, Subsurface drainage, Unsaturated flow, Mathematical models, Moisture content, Groundwater, Aquifers, Soil water, Capillary action.
Identifiers: Water-air content, *Vertical column model, *Sand column model.

When both water and air movements are included in the formulation of infiltration or drainage problems, the problems of infiltration and drainage exhibit a natural symmetry. Methods of solution for one problem are applicable to the other type of problem. An equation of drainage was derived and it had precisely the same functional form as the equation derived for infiltration in a previous paper. (Prickett-ISWS)

W76-06165

THE ROLE OF GROUNDWATER IN RURAL SUPPLIES IN GHANA,
Ghana Water and Sewerage Corp., Bolgatanga.
For primary bibliographic entry see Field 4B.
W76-06169

NATURAL ISOTOPES IN SURFACE AND GROUNDWATER FROM ARGENTINA,
Council for Scientific and Industrial Research, Pretoria (South Africa). Natural Isotopes Div.
J. C. Vogel, J. C. Lerman, and W. G. Mook.
Hydrological Sciences Bulletin, Vol. 20, No. 2, p 203-221, June 1975. 10 fig, 2 tab, 31 ref.

Descriptors: *Isotope studies, *Surface waters, *Groundwater, *Radioactive dating, *Tracking techniques, Groundwater recharge, Dating, Age, Tracers, Analytical techniques, Oxygen isotopes, Carbon radioisotopes, Stable isotopes, Radioisotopes, Background radiation.
Identifiers: *Argentina, Water origin, Flow direction, Infiltration areas, Recharge areas, Carbon 14, Oxygen 18, Natural isotopes.

The naturally occurring isotopes radiocarbon, stable carbon-13 and oxygen-18 have been studied in surface and groundwater from six regions in Argentina. The O18 content of river and groundwater was used to trace the origin of the water, using its relation with altitude of the catchment area. The C14 ages obtained for groundwater range from recent to about 30,000 years and clearly indicate the direction of flow in some areas. Flow velocities of 3 to 10 m/year were found. (Prickett-ISWS)
W76-06185

HOT SPRINGS OF RHODESIA: THEIR NOBLE GASES, ISOTOPIC AND CHEMICAL COMPOSITION,
University of the Witwatersrand, Johannesburg (South Africa). Nuclear Physics Research Unit.
For primary bibliographic entry see Field 2K.
W76-06190

PUBLIC GROUNDWATER SUPPLIES IN PUTNAM COUNTY,
Illinois State Water Survey, Urbana.
For primary bibliographic entry see Field 4B.
W76-06237

A COMBINED MODEL OF WATER TABLE AND RIVER STAGE EVOLUTION,
Colorado State Univ., Fort Collins. Engineering Research Center.
For primary bibliographic entry see Field 2A.
W76-06380

SOLUTION CHEMISTRY, MASS TRANSFER, AND THE APPROACH TO CHEMICAL EQUILIBRIUM IN POROUS CARBONATE ROCKS AND SEDIMENTS,
Illinois Univ., Urbana. Dept. of Geology.
For primary bibliographic entry see Field 2K.
W76-06384

THICK BH HORIZONS IN THE NORTH CAROLINA COASTAL PLAIN: I. MORPHOLOGY AND RELATION TO TEXTURE AND SOIL GROUND WATER,
Soil Conservation Service, Beltsville, Md.
For primary bibliographic entry see Field 2G.
W76-06402

A COMPARISON OF THE GREEN-AMPT AND PHILIP TWO-TERM INFILTRATION EQUATIONS,
Hawaii Univ., Honolulu. Dept. of Civil Engineering.

For primary bibliographic entry see Field 2G.
W76-06404

COMPUTING PHREATIC GROUNDWATER STORAGE,
Agricultural Research Service, Tifton, Ga.
L. E. Asmussen, and A. W. Thomas.
Research Bulletin 153, March 1974. 23 p, 9 fig, 3 tab, 10 ref.

Descriptors: *Storage, *Groundwater, Groundwater basins, Water balance, Hydrologic budget, Watersheds(Basins), Routing, Hydrology, Geomorphology, Water resources, Ponds, Seepage, Water supply, Aquifers, Transmissivity, Soil water, Hydrologic properties, Porosity, Geologic control, Hypsometric analysis, Water table, Distribution patterns, Maps, Rain, Irrigation, Evapotranspiration, Groundwater movement, Inflow, Equations, Methodology.
Identifiers: *Southern Coastal Plain, *Atlantic Flatwoods, *Grid system.

Shallow Quaternary aquifers, which are underlain by relatively tight materials, are especially important in the Southern Coastal Plain. These sandy materials cause a large percentage of the precipitation to infiltrate, move laterally, and run off as return flow to ponds, pits, and streams. Quantitative methods for computing and expressing shallow groundwater volume and distribution within a watershed were discussed and compared. A grid method to subdivide the watershed into subareas for computing groundwater storage was found suited to all groundwater conditions, whereas, other techniques tested required a constant area. A pond and watershed water balance was made for 13 periods to exercise the principles suggested. The pond water balance showed a groundwater loss eight of the 13 periods; however, there was a total net groundwater gain of 0.82 acre-foot. A watershed water balance was made for the same periods using the computed groundwater seepage. The residual for this water balance was soil water, which showed a net gain of 1.36 area-inches. These techniques and descriptions will permit the routing of both surface and subsurface water through a watershed and will assign quantitative values to the hydrologic processes. (Visocky-ISWS)
W76-06409

ADVANCES IN HYDROSCIENCE, VOLUME 10-1975.
For primary bibliographic entry see Field 8B.
W76-06412

MODELING TECHNIQUES FOR GROUNDWATER EVALUATION,
Illinois State Water Survey, Urbana.
T. A. Prickett.
In: Advances in Hydroscience, Volume 10-1975. Academic Press, New York, New York, p 1-143, 1975. 69 fig, 6 tab, 332 ref.

Descriptors: *Groundwater, *Model studies, *Analog models, *Computer models, Mathematical models, Resistance networks, Hybrid computers, Finite element analysis, Computer programs, Numerical analysis, Analytical techniques, Simulation analysis, Aquifers, Groundwater movement.
Identifiers: *Groundwater basin management, *Groundwater reservoirs, *Sand tank models, Groundwater evaluation.

The most frequently cited differential equations governing the flow of groundwater were outlined. The presentation of these equations introduced common nomenclature. The modeling techniques were then outlined under the groups of analogs, analytical and numerical techniques, and sand tank models. Each section included the basic theory, a brief background of the available literature, derivation of formulas, scale factor definition when necessary, a case history when ap-

propriate, model verification procedures, and a discussion of advantages, disadvantages, and errors. References were grouped by subject matter at the end of the article and thus depart from the usual single alphabetical listing. The reference section has subject matter headings identical with those of the text. The reference list is extensive, containing papers not necessarily cited in the text. This was done so that the reader would have a more complete bibliography for further research if desired. Although studies of individual well hydraulics were mentioned, the emphasis was given to regional groundwater resource evaluation. Details have been purposely omitted since they can be found in the literature. (See also W76-06412) (Prickett-ISWS)
W76-06413

HYDROTHERMAL CONVECTION IN SATURATED POROUS MEDIA.
Bordeaux-1 Univ., Talence (France).
M. A. Combarrous, and S. A. Bories.
In: *Advances in Hydrosience*, Volume 10-1975, Academic Press, New York, New York, p 231-307, 1975. 60 fig, 1 tab, 86 ref.

Descriptors: *Porous media, *Aquifers, *Heat transfer, *Model studies, Theoretical analysis, Laboratory tests, Thermal water, Geothermal studies, Subsurface waters, Convection, Mixing, Temperature, Thermal properties, Snow cover, Aquifer characteristics, Boundaries(Surfaces), Boundary processes, Dimensional analysis, Mathematical studies, Numerical analysis, Saturated flow, Groundwater movement.
Identifiers: Hydrothermal convection, Thermohaline convection.

Generally speaking, convective movements in a porous layer have two main effects. They first tend to homogenize the whole fluid volume where they take place. They also help produce a nonuniform in situ temperature distribution characterized by hot and cold zones. Thermal convection in aquifers must be taken into account for: (1) the contribution of the 'homogenizing effects' of convective movements to the spreading of a pollutant, (2) the influence on the efficiency of industrial plants using hot deep-lying groundwater, and (3) the influence of a nonuniform temperature field resulting from convection in infrared photographic exploration. Subject areas presented were heat transfer in porous media, mathematical formulations for thermal convection, theoretical approaches, experimental results for free convection in horizontal layers, free convection in sloped areas, numerical computations for free convection, combined free and forced thermal convection, and free convection in more complex configurations. Some results obtained for complex configurations were given in an attempt to explain that, in the field of thermal convection in porous media, numerous problems still have to be solved. It was emphasized that, even in the classic case of natural convection in homogeneous media for a simple configuration, the solutions to some research problems have not been completely formulated. For instance, this is the case for the transition criteria between the various types of flow observed in sloping layers bounded by isothermal planes, or for possible improvements in the mathematical description of heat transfer. (See also W76-06412) (Humphreys-ISWS)
W76-06415

THE MIOCENE AQUIFER SYSTEM IN MISSISSIPPI.
Geological Survey, Jackson, Miss.
For primary bibliographic entry see Field 7C.
W76-06445

AQUEOUS SOLUBILITY OF PETROLEUM AS APPLIED TO ITS ORIGIN AND PRIMARY MIGRATION.
Geological Survey, Denver, Colo. Office of Energy Resources.

For primary bibliographic entry see Field 4B.
W76-06455

SOUTHEASTERN MICHIGAN WATER-RESOURCES STUDY: GROUND WATER AND GEOLOGY.
Geological Survey, Lansing, Mich.
For primary bibliographic entry see Field 4B.
W76-06457

PROGRESS REPORT ON THE WATER RESOURCES INVESTIGATION OF MARTIN COUNTY, FLORIDA.
Geological Survey, Tallahassee, Fla.
For primary bibliographic entry see Field 4B.
W76-06459

GROUND-WATER IN NEW MEXICO, 1973.
Geological Survey, Albuquerque, N. Mex.
For primary bibliographic entry see Field 7C.
W76-06460

SYSTEMATIC DESIGN OF LEGAL REGULATIONS FOR OPTIMAL SURFACE -GROUND-WATER USAGE - PHASE 2.
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
For primary bibliographic entry see Field 4B.
W76-06551

GROUNDWATER RESOURCES OF ALTUNKUPRI AREA.
Institute for Applied Research on Natural Resources, Baghdad (Iraq).
For primary bibliographic entry see Field 4B.
W76-06576

FINITE STATE MIXING-CELL MODELS.
Arizona Univ., Tucson. Dept. of Hydrology and Water Resources.
E. S. Simpson, and L. Duckstein.
Typescript, 1975. 19 p, 7 fig, 2 tab, 5 ref.

Descriptors: *Computer models, *Karst hydrology, *Simulation analysis, *Groundwater movement, *Mass transfer, Model studies, Groundwater, Synthetic hydrology, Flow, Groundwater resources, Energy transfer, Mathematical studies, Probability, Hydrogeology.
Identifiers: Finite State Mixing-Cell Models.

In this first paper of a two-part series a quasi-physical, finite-state model is developed for modeling karstic water resources in a systems framework. The model consists of a set of interconnected cells of any desired size through which the transport of water and dissolved matter is represented by a sequence of finite states governed by a set of recursive equations. Energy transport is represented by rules governing a change of cell size from one iteration to the next. Each elementary cell may be either a pure mixing-cell or a cell that simulates partial or complete piston flow (no mixing). The proposed finite-state model responds to a real need created by the impossibility of solving the inverse problem with partial differential equations, and the lack of physical basis of black box models. In addition, the model can deal with mass transport data (many different tracers) and energy transport data (hydrograph and change in storage) and may lead to useful managerial applications such as estimates of the probability distribution function of storage volume. It is simple, flexible and inexpensive to operate, but much depends on the skill and intuition of the modeler in devising a model based on incomplete and scattered data. (See also W76-06595) (Robinet-Arizona)
W76-06594

UNCERTAINTIES IN KARSTIC WATER RESOURCES SYSTEMS.
Arizona Univ., Tucson. Dept. of Systems and Industrial Engineering.
L. Duckstein, and E. S. Simpson.
Typescript, 1975. 17 p, 4 fig, 3 tab, 17 ref.

Descriptors: *Karst hydrology, *Groundwater movement, *Risks, *Systems analysis, *Computer models, Management, Simulation analysis, Model studies, Groundwater, Synthetic hydrology, Flow, Hydrogeology, Groundwater resources, Probability.
Identifiers: Finite State Mixing-Cell Model.

A framework to describe, analyze, and trade off uncertainties present in karstic water resources systems. Finite state model (See W76-06594) is presented to illustrate the effect of some of the physical uncertainties, particularly input upon decision making. A discrete system framework is used to establish a two-way classification of five system elements versus six types of uncertainties. Typical system elements include rainfall (input), cavity size (state), rainfall discharge relationships (state transition function), benefit-cost (output), and loss curves (output function). Uncertainty types may be natural, model, sample, economic, technological, or strategic. The finite state model is used to find how input uncertainty affects output, and a complete Bayesian analysis of input uncertainty leads to the evaluation of the value of perfect information and the worth of one more sample point. Information provided on the effect of various uncertainties make possible optimal allocation of resources, decreasing the overall uncertainty in the decision-making process. (Robinet-Arizona)
W76-06595

WEATHERING AND HYDROGEOLOGY OF THE BRUMUNDAL SANDSTONE, SOUTHERN NORWAY.
Norges Landbruks-hoegskole, Vollebakk. Geologisk Institutt.
J. O. Englund, and P. Jorgensen.
Nordic Hydrology, Vol. 6, No. 1, p 43-62, 1975. 10 fig, 5 tab, 20 ref.

Descriptors: *Groundwater, *Sandstones, *Hydrogeology, Europe, Wells, Montmorillonite, Porosity, Permeability, Cation exchange, Groundwater resources, Groundwater availability, *Weathering, *Water wells.
Identifiers: *Brumunddal sandstone, *Norway, Water-deposited sediments, Hematite pigment, Plagioclase, Groundwater composition.

During the last decades several wells giving yields up to 100,000 liter per hour have been drilled in the reddish Brumunddal Sandstone, which covers an area of approximately 10 sq km near lake Mjosa, Southern Norway. Most of these wells have yields below 10,000 liter per hour, and those with higher yields are situated along prominent fracture zones. Textural data strongly support the assumption of an eolian origin for this sandstone, but water-deposited sediments are found within the formation. Most of the grains are coated with a hematite pigment, which was probably epigenetically formed. Post-sedimentary but preglacial weathering processes have transformed plagioclase to montmorillonite. This has changed the porosity as well as the permeability and increased the cationic exchange capacity. A transformation of plagioclase is in agreement with the groundwater composition. (Lee-ISWS)
W76-06676

MONITORING GROUND-WATER QUALITY NEAR A SANITARY LANDFILL.
Earthview, Incorporated, Toledo, Ohio.
For primary bibliographic entry see Field 5A.
W76-06684

Field 2—WATER CYCLE

Group 2F—Groundwater

RAPID RECHARGE IN A LIMESTONE AQUIFER,

Birmingham Univ., (England). Dept. of Civil Engineering.
I. A. Fox, and K. R. Rushton.
Ground Water, Vol. 14, No. 1, p 21-27, January-February 1976. 6 fig, 1 tab, 5 ref, 1 append.

Descriptors: *Groundwater, *Recharge, *Model studies, Computer models, Analog models, Infiltration rates, Soil water movement, Aquifer characteristics, Natural recharge, Mathematical models, Precipitation (Atmospheric).
Identifiers: Limestone aquifers, Seasonal variations, Piezometric head.

The introduction of an infiltration mechanism called rapid recharge assists in the mathematical modeling of large seasonal variations in the response of the confined portion of a limestone aquifer. Such modeling employs the technique of using an interactive analogue-digital computer, together with a new method of utilizing standard hydrological input data. (Gibb-ISWS)
W76-06685

FIBONACCI SEARCH FOR HIGH-YIELD WELL SITES,

California Univ., Davis. Dept. of Civil Engineering.
For primary bibliographic entry see Field 4B.
W76-06686

PUMPING TEST ANALYSIS WHEN PARAMETERS VARY WITH DEPTH,

Birmingham Univ., (England). Dept. of Civil Engineering.
For primary bibliographic entry see Field 4B.
W76-06687

2G. Water In Soils

DRAINAGE RATES FROM A VERTICAL COLUMN,

Colorado State Univ., Fort Collins.
For primary bibliographic entry see Field 2F.
W76-06165

INFILTRATION OF ORGANIC PHOSPHATE COMPOUNDS IN SOIL,

California Univ., Davis. Dept. of Land, Air, and Water Resources.
For primary bibliographic entry see Field 5B.
W76-06170

BULK DENSITY SAMPLER FOR DEEP SOIL PROFILES,

California Univ., Riverside.
For primary bibliographic entry see Field 7B.
W76-06171

ROLE OF BOGS IN THE FORMATION OF SPRING FLOOD RUNOFF LOSSES IN THE DRAINAGE BASINS OF THE NORTHWESTERN EUROPEAN USSR,

For primary bibliographic entry see Field 4A.
W76-06175

MELT-WATER LOSSES THROUGH INFILTRATION INTO PODZOLIC SOILS AND CHERNOZEMS,

V. V. Romanov, K. K. Pavlova, and I. L. Kalyuzhnyy.
Soviet Hydrology, Selected Papers, No. 1, p 32-42, 1974. 3 fig, 5 tab, 8 ref, 1 append. Translated from Trudy Gossudarstvennogo Gidrologicheskogo Instituta, No. 214, p 106-122, 1974.

Descriptors: *Melt water, *Runoff, *Infiltration, *Soils, Podzols, Chernozems, Snow, Snowfall, Melting, Snowmelt, Forests, Forest soils, Frozen soils, Soil moisture.
Identifiers: *USSR.

Meltwater infiltration into frozen soil depends on the initial moisture and temperature of the soil and its thermophysical properties. The phase composition of water in freezing soil has the greatest effect. The phase transformations are intense in the temperature interval from 0 to -3.0 C in the loamy soils of the basins of the Don and Tosna rivers, and the content of unfrozen water changes little at temperatures from -5 to -20 C. At negative soil temperatures of about -10 to -20 C, the content of unfrozen water amounts to 10-16% in Chernozem loams and to 3-7% in Podzolic soils. The amount of unfrozen water depends on the specific surface of the soil and this relation differs for well structured and poorly structured soils. At temperatures from 0 to -10 C an impermeable layer forms in Chernozem loams and Podzolic soils at an initial moisture content equal to or greater than 0.3-0.4 of volume (50-60% of total pore volume). The volume of water lost through infiltration into frozen soils in the forest zone is apparently determined mainly by the water absorbing capacity of the soils. Therefore, the spring flood runoff coefficient in wooded drainage basins depends on the moisture deficit in the forest soils. (Sims - ISWS)
W76-06181

ORIENTATION OF SOIL STRIPES CAUSED BY NEEDLE ICE,

British Columbia Univ., Vancouver. Dept. of Geography; and British Columbia Univ., Dept. of Geological Sciences.
For primary bibliographic entry see Field 2C.
W76-06187

SUBARCTIC PLANT COMMUNITIES AND ASSOCIATED LITTER AND SOIL PROFILES IN THE CARIBOU CREEK RESEARCH WATERSHED, INTERIOR ALASKA,

Cold Regions Research and Engineering Lab., Fairbanks, Alaska.
For primary bibliographic entry see Field 4D.
W76-06194

EFFECT OF PHOSPHORUS AND SULPHURSPHATES ON MOVEMENT OF PHOSPHORUS AND SULPHUR IN TWO SOILS,

New Zealand Fertilizer Manufacturers Research Association, Inc., Papatoetoe.
F. B. Muller, and G. McSweeney.
N Z J Exp Agric. 2(1): 53-62. Illus. 1974.

Descriptors: *White clover, Clovers, *Phosphates, Phosphorus, Sulphur, Nutrients, *Soil analysis, *Fertilizers, Leaching, Particle size, Granules, *Soil contamination effects.
Identifiers: Trifolium-Repens.

The uptake of P and S from superphosphates in granular and powder forms by New Zealand white clover (Trifolium repens L. 'Grasslands Huia') on 2 soils and the movement of these nutrients into the drainage were studied. At the rate of fertilizers used and the range of particle sizes there were no significant differences between the powdered and granulated material in total herbage production. Similarly, there were no significant differences between ordinary superphosphate and the S-fertilized materials in dry matter production. On soils with low S-retention capacity use of powdered fertilizers was likely to lead to large losses of S by leaching. For calcium sulfate fertilizers granulation greatly reduced leaching losses. Losses with elemental S were also reduced by granulation or by the use of coarser S. On S-deficient soils use of phosphates alone would give reduced yields, as would S alone on phosphate-deficient soils. Use of S alone to correct S deficiency would run the risk of reduced yield in time due to insufficient P.

The converse, namely the use of superphosphate, would apply on P-deficient soils, which would ultimately become S deficient. Unlike S, there was no movement of P into leachates during the trial, which indicates little likelihood of P enrichment of natural waters by this pathway.--Copyright 1975, Biological Abstracts, Inc.
W76-06242

CADMIUM AND ZINC CONTENTS OF CORN LEAF AND GRAIN PRODUCED BY SLUDGE-AMENDED SOIL,

Illinois Univ. at Urbana-Champaign. Dept. of Agronomy.
For primary bibliographic entry see Field 5A.
W76-06304

SIGNIFICANCE OF TRACE METALS AND NITRATES IN SLUDGE SOILS,

Environmental Protection Agency, Columbus, Ohio. Div. of Waste Management and Engineering.
For primary bibliographic entry see Field 5E.
W76-06307

PHOSPHATE SORPTION CHARACTERISTICS OF SOILS TREATED WITH DOMESTIC WASTE WATER,

Connecticut Agricultural Experiment Station, New Haven.
For primary bibliographic entry see Field 5B.
W76-06330

EFFECT OF SEWAGE SLUDGE ON SOME SOIL PHYSICAL PROPERTIES,

Agricultural Research Service, Beltsville, Md. Agricultural Environmental Quality Inst.
For primary bibliographic entry see Field 5E.
W76-06331

TRACE ELEMENT CONCENTRATIONS OF SEWAGE TREATMENT PLANT EFFLUENTS AND SLUDGES; THEIR INTERACTIONS WITH SOILS AND UPTAKE BY PLANTS,

California Univ., Riverside. Dept. of Soil Science and Agricultural Engineering.
For primary bibliographic entry see Field 5B.
W76-06332

CHEMICAL COMPOSITION AND YIELD OF SOYBEANS AS AFFECTED BY IRRIGATION AND DEEP PLACEMENT OF LIME, PHOSPHORUS AND POTASSIUM,

Virginia Polytechnic Inst. and State Univ., Blacksburg. Coll. of Agriculture.
For primary bibliographic entry see Field 3C.
W76-06338

RECOVERY FROM SOIL COMPACTION ON BLUEGRASS RANGE IN THE BLACK HILLS,

Forest Service (USDA), Fort Collins, Colo. Rocky Mountain Forest and Range Experiment Station.
For primary bibliographic entry see Field 4D.
W76-06362

THE GROWTH OF DISTURBANCES IN UNSTABLE INFILTRATION FLOWS,

Commonwealth Scientific and Industrial Research Organization, Canberra (Australia), Div. of Environmental Mechanics.
J. R. Philip.
Soil Science Society of America Proceedings, Vol. 39, No. 6, p 1049-1053, November-December 1975. 3 fig, 3 ref.

Descriptors: *Soil water movement, *Unsaturated flow, *Mathematical models, *Laboratory tests, *Infiltration, Hydrodynamics, Heterogeneity, Moisture content, Wetting, Depth, Pressure head, Atmospheric pressure, Velocity, Equations, Hydraulic conductivity.

Identifiers: Disturbances, *Unstable flow, Delta-function model, Wave number, Amplification, Fingering.

The stability analysis of the delta-function model of infiltration yields a maximum wave-number for unstable disturbances, Merit, and a wave-number for maximum amplification, M^* . The 'column effect,' i.e. the suppression of instability in laboratory columns, depends on Merit; and the dimensions of fingers in unstable flows can be expected to depend on M^* . When instability is induced by a sudden jump of G , the water pressure gradient behind the wetting front, Merit and M^* may be evaluated simply and directly. When, on the other hand, instability emerges during gradual increase of G , it is necessary to study the amplification of disturbances during the whole course of increase of G through positive values. Such a study was made for one example of instability induced by air compression and for one where it was induced by increase of conductivity with depth. Both exhibited qualitatively similar patterns of amplification: disturbances of small M (wave-number) begin to be amplified sooner, but ultimately overtaken by some disturbances of larger M starting later. Definite values of M^* were found, and the results discussed with special reference to fingering and to the column effect. (Visocky-ISWS) W76-06398

LOESS IN OHIO IN RELATION TO SEVERAL POSSIBLE SOURCE AREAS: I. PHYSICAL AND CHEMICAL PROPERTIES, Ohio State Univ., Columbus. Dept. of Agronomy. For primary bibliographic entry see Field 2J. W76-06399

LOESS IN OHIO IN RELATION TO SEVERAL POSSIBLE SOURCE AREAS: II. ELEMENTAL AND MINERALOGICAL COMPOSITION, Ohio State Univ., Columbus. Dept. of Agronomy. For primary bibliographic entry see Field 2J. W76-06400

NITRATE MOVEMENT AND ITS DISTRIBUTION IN THE SOIL PROFILE OF DIFFERENTIALLY FERTILIZED CORN WATERSHEDS, Agricultural Research Service, Cheyenne, Wyo. For primary bibliographic entry see Field 5B. W76-06401

THICK BH HORIZONS IN THE NORTH CAROLINA COASTAL PLAIN: I. MORPHOLOGY AND RELATION TO TEXTURE AND SOIL GROUND WATER, Soil Conservation Service, Beltsville, Md. R. B. Daniels, E. E. Gamble, and C. S. Holzhey. Soil Science Society of America Proceedings, Vol. 39, No. 6, p 1177-1181, November-December 1975. 6 fig, 1 tab, 9 ref.

Descriptors: *Soil horizons, Stratigraphy, *Geomorphology, *Decomposing organic matter, *Humic acids, *North Carolina, Analytical techniques, Humus, Geology, Organic matter, Organic soils, Organic compounds, Sediment sorting, Soil chemistry, Sediment transport, Soil texture, Soil water, Groundwater, Humic acids, Coastal plains, Groundwater movement. Identifiers: Spodic horizons, *Spodosols, *Bh horizons, Pink Hill area(NC), Soluble organics, Humus accumulations.

Spodosols in North Carolina have thick, vertically continuous Bh horizons wherever the parent material is a sand or loamy sand texture that has a high water table and a downward flow of groundwater. These Bh horizons are 5-9 m thick, and their lower boundaries are always a few centimeters above a less permeable layer or a bed of green-gray sand. Pollen counts and the general morphology indicated that the thick Bh horizons

are post depositional features. Percolating organics, monitored by shallow wells, move from the surface downward in quantities greater than necessary to account for the whole Bh horizon thickness. (See also W76-06403) (Henley - ISWS) W76-06402

THICK BH HORIZONS IN THE NORTH CAROLINA COASTAL PLAIN: II. PHYSICAL AND CHEMICAL PROPERTIES AND RATES OF ORGANIC ADDITIONS FROM SURFACE SOURCES, Soil Conservation Service, Beltsville, Md. C. S. Holzhey, R. B. Daniels, and E. E. Gamble. Soil Science Society of America Proceedings, Vol. 39, No. 6, p 1182-1187, November-December 1975. 3 fig, 6 tab, 14 ref.

Descriptors: *Soil horizons, *Decomposing organic matter, *Chemical properties, *Physical properties, *Humic acids, *North Carolina, Atlantic Coastal Plain, Humus, Organic matter, Analytical techniques, Organic soils, Soil chemistry, Sediment transport, Chemistry, Chemical analysis, Mineralogy, *Path of pollutants. Identifiers: *Spodic horizons, *Bh horizons, Mobile organic matter, Organic enrichment, Pink Hill area(NC), Mobile constituents, Exchangeable salts.

Thick Bh horizons in siliceous sands of the North Carolina Coastal Plain have essentially no extractable iron, and very small quantities of calcium, magnesium, and potassium. Aluminum is the dominant cation and the exchange properties of the Bh horizons are dominated by Al and organic carbon. One to two grams of total Ca, Mg, and Na/sq m per yr are being added to these soils by rainfall and recycling. From 3 to 40 g of carbon/sq m per yr is available to move into the solution below 10 cm. This is enough carbon to develop a Bh horizon 7 m thick in less than 30,000 years. The mechanism that immobilizes the carbon to form the Bh horizon is open to question. It was postulated that bases, pH changes, or other aspects of the chemical environment may have immobilized the carbon initially, but these causes have subsequently been removed or changed through leaching. Another alternative is organo-mineral bonding such as with silica on quartz surfaces that may be the major factor in the immobilization of carbon. (See also W76-06402) (Henley - ISWS) W76-06403

A COMPARISON OF THE GREEN-AMPT AND PHILIP TWO-TERM INFILTRATION EQUATIONS, Hawaii Univ., Honolulu. Dept. of Civil Engineering. Y-S. Fok. Transactions of the American Society of Agricultural Engineers, Vol. 18, No. 6, p 1073-1075, November-December 1975. 1 tab, 12 ref.

Descriptors: *Infiltration, *Equations, *Soil water movement, Darcys law, Seepage, Velocity, Hydraulic conductivity, Unsaturated flow, Percolation, Wetting, Soil surfaces, Head loss, Depth, Pore pressure, Porosity, Soil profiles, Soil moisture, Sorption. Identifiers: *Green-Ampt equation, *Philip two-term equation.

The Green-Ampt equation is regaining popularity. The equation is a simple algebraic expression with a physical basis and utilizes parameters that can be evaluated from soil physical properties. The Philip two-term equation is also gaining popularity, because it has a theoretical basis and is adapted to fitting to observed infiltration data. The Philip two-term equation was shown to be derivable from the Green-Ampt equation, and the differences between these two equations were tabulated. The maximum difference is less than 17%. (Visocky - ISWS) W76-06404

RECOVERY FROM SOIL COMPACTION ON BLUEGRASS LANGE IN THE BLACK HILLS, Forest Service (USDA), Rapid City, S. D. Rocky Mountain Forest and Range Experiment Station. H. K. Orr. Transactions of the American Society of Agricultural Engineers, Vol. 18, No. 6, p 1076-1081, November-December 1975. 10 fig, 4 tab, 10 ref.

Descriptors: *Soil compaction, *Bluegrasses, *Ranges, *South Dakota, Soils, Soil mechanics, Compaction, Livestock, Climates, Overland flow, Infiltration, Percolation, Precipitation(Atmospheric), Bulk density, Vegetation, Compacted soils, Grazing, Range management, Runoff. Identifiers: *Bluegrass range, *Black Hills(SD), Recovery, Soil core samples, Livestock grazing, Trampling, Overland runoff, Macropore volume, Fencing.

Intensive livestock grazing in bluegrass meadows and stream-bottoms in the Black Hills has resulted in compaction of the soil. Not until the second year after fencing did soils show significant increases in macropore volume. Infiltration capacities also increased and summer runoff decreased. One soil was a medium-textured silt loam and the other was a sandy loam. At a third site where soil was medium-textured but high in organic matter content and with a low bulk density, soil responses were uncertain. Infiltration increases started to appear at about the same time as improvements in soil structure. Protection from grazing and trampling resulted in less summer storm runoff in the first growing season and also in each of the following three years. After the first winter, snowmelt runoff far exceeded summer storm runoff at all three sites. Overall results clearly indicated that more than one season protection was necessary for significant soil recovery, and degree of recovery continued up to at least four years, the duration of this study. (Roberts - ISWS) W76-06405

METHOD FOR COMPUTING EVAPORATION DURING THE SNOW MELTING AND FLOOD PERIOD IN THE CENTRAL CHERNOZEM REGIONS OF THE EUROPEAN USSR, For primary bibliographic entry see Field 2D. W76-06407

COMPUTING PHREATIC GROUNDWATER STORAGE, Agricultural Research Service, Tifton, Ga. For primary bibliographic entry see Field 2F. W76-06409

SOIL WATER POTENTIAL AND PLANT BEHAVIOR: A CASE MODELING STUDY WITH SUNFLOWERS, Centre National de la Recherche Scientifique, Montpellier (France). Centre d'Etudes Phytosociologiques et Ecologiques. C. H. M. Van Bavel. Oecol Plant. 9(2), p 89-109, 1974.

Descriptors: *Soil water, Model studies, Soil-water-plant relationships, Crop response, Crops, Carbon dioxide, Energy, Behavior. Identifiers: Potential, *Sunflowers.

A model to simulate the effect of soil water potential on the gas exchange by a plant leaf canopy is presented. The radiant energy distribution in the canopy is obtained by the Duncan method, as modified by Stewart, using leaf architecture and optics as inputs. The CO₂ and water vapor exchange for each leaf layer is found from a leaf gas and energy exchange submodel, previously described, in which the parameters of the aerial environment and the soil water potential are the inputs. The gas exchange of the entire canopy was calculated by the proposed model for a sunflower crop using the following assumed levels of soil

Field 2—WATER CYCLE

Group 2G—Water In Soils

water potential: 0, -5, -10 and -15 bar. The calculated daily values of CO₂ assimilation and transpiration were compared with actually measured values in the field. A reasonable agreement of well within 20% was obtained, and the hourly distribution also agreed with measured behavior. Detailed aspects of the model application showed that, in the sunflower crop, the soil water potential affects stomatal resistance so as to reduce both CO₂ assimilation and transpiration when the soil becomes drier. A slight midday depression of the assimilation is also predicted for soil water potentials less than -5 bar. The results illustrate how environmental and plant physiological data, specifically regarding CO₂ assimilation and water relations, can be combined to enable a reconstruction of the behavior of a crop-environment system under conditions of a limited water supply in the soil.—Copyright 1975, Biological Abstracts, Inc. W76-06461

PORE WATER PRESSURE MEASURING DEVICE,

P. O. Jonell, and K. I. Elmgren.
U.S. Patent No. 3,935,745, 4 p, 6 fig, 4 ref; Official Gazette of the United States Patent Office, Vol 943, No 1, p 129, February 3, 1976.

Descriptors: *Patents, *Pore water, *Pore pressure, *Water pressure, *Porous media, *Soil physical properties, Soil compaction, Measurement, Subsurface water, Instrumentation.

A pore water pressure meter of the kind used to measure the water pressure inside masses of earth or clay is described. The pore water pressure meter incorporates a pressure meter, the force or motion is dependent on the pore water pressure to be measured, and a force meter (e.g. an extensometer) arranged to be actuated by the pressure meter. The meter incorporates a power member which is arranged to apply a force on the pressure meter of such magnitude as to override the force exerted by the meter so as to prevent the pressure meter from affecting the force meter, and to thereafter remove the force from the pressure meter and allow the latter to again transmit its force to the force meter. It is possible to read the measuring value of the pressure meter as soon as the force of the pore water pressure meter has been removed, and, after re-application of the force of the pressure meter, to read the measure value of the force meter caused by the prevailing water pressure. There is no need to pull the rod together with the pore water pressure meter out of the mass of earth in order to recalibrate it. Before forcing the pressing meter down into the mass of earth it is possible to establish various frequency curves in the neighborhood of the zero pressure frequency curve and then, after the change of the zero pressure frequency, use any one of these extra curves as a reference curve in the subsequent measuring operations. (Sinha - OEIS) W76-06477

SOIL MOISTURE REGIME OF UNSATURATED ZONE IN SOME ARID REGIONS,

Institute for Applied Research on Natural Resources, Baghdad (Iraq).
J. S. Dougrameji.
Technical Bulletin 81, June, 1975. 17 p, 3 fig, 4 tab, 11 ref.

Descriptors: *Soil-water-plant relationships, *Soil moisture, *Arid lands, *Drainage engineering, *Irrigation effects, Moisture content, Fallowing, Infiltration, Groundwater, Permeability, Soil management, Soil physical properties, Zone of aeration, Alfalfa, Irrigated land, Water injury, Wheat, Agriculture, Orchards.
Identifiers: *Diyala River Basin(Iraq).

A study of soil-water relationships under different cropping patterns was carried out in the Fudhaliya Experimental Station located in the Diyala river basin, 8 km northeast of Baghdad, Iraq. The basic

hydrophysical properties of the soil in the experimental area are described as well as the changes which resulted in the soil moisture regime of the unsaturated zone under different crops for the period 1969-1971. The soils are characterized by heavy texture, high water holding capacity, low permeability, low infiltration rate, and slow but steady groundwater recharge. Because of the steady recharge and lack of a drainage system, a steady rise in the water table and consequent salinization of the soil was noted. Results indicated that soil cracks play an important role in reducing the soil moisture content through evaporation, and further indicated the need for a drainage system and lining of irrigation canals. The average annual increase in the actual moisture content of the soil was 3.1 percent, 5.3 percent, and 11.2 percent in wheat, alfalfa, and orchard respectively in comparison to fallow land. The increase in the actual moisture content of the soil between August 1968 & August 1970 was 0.5 percent, 0.9 percent, 6.1 percent, and 11.5 percent in wheat, fallow, alfalfa and orchard plots respectively. Recommendations include better soil-water management using an improved irrigation system, improvement of soil structure by mulching and deep plowing, and suitable crop rotations. (Robinett-Arizona) W76-06578

INVESTIGATION OF SOME PHYSICAL PROPERTIES OF THE SOILS IN THE DALMAJ PILOT PROJECT AREA,

Institute for Applied Research on Natural Resources, Baghdad (Iraq).
A. H. Al-Rawi, J. Z. Al-Rawi, H. J. Van der zel, and J. Vos.
Technical Bulletin 77, November, 1975. 45 p, 20 fig, 13 tab, 5 ref.

Descriptors: *Permeability, *Soil water movement, *Moisture content, Soil physical properties, *Irrigation effects, Infiltration, Soil analysis, Soil texture, Soil structure, Soil moisture, Field capacity, Retention, Bulk density, Soil investigations, Irrigated land, Correlation analysis.
Identifiers: *Dalmaj Pilot Project Area(Iraq).

Soil physical investigations at the Dalmaj Pilot Project Area situated in the northern part of Mazzaq Main Canal region in Iraq are described. Five experimental sites representing basin soils, silted river basin soils and irrigation levee soils were used for infiltration tests, soil moisture retention determinations and permeability measurements. Soil texture ranges from clay to loam with the total range in clay particles from 20 to 67 percent, the range in silt particles from 31 to 73 percent, and the range in sand particles from 2 to 20 percent. Average bulk density ranges from 1.4 to 1.6 g/cu cm, while permeability ranges from 50 to 110 cm/24 hours with 90 cm/24 hours as an overall average. Investigation of soil moisture showed that after irrigation the upper 30 cm of the soil profile was saturated with water, and at some sites the water did not penetrate below the 45 to 60 cm depth. Results indicated no sharp wetting front but a gradual decrease of the moisture content at each depth after irrigation. Results of the different soil physical determinations are presented in tables and graphs as are correlations between texture, available moisture and bulk density of the various soil units. (Robinett-Arizona) W76-06579

CHARACTERISTICS AND CLASSIFICATION OF TWO SOILS IN DIYALA BASIN, IRAQ,

Institute for Applied Research on Natural Resources, Baghdad (Iraq).
J. S. Dougrameji.
Technical Bulletin 84, August, 1975. 20 p, 4 fig, 3 tab, 11 ref, append.

Descriptors: *Soil classification, *Soil chemical properties, *Soil physical properties, *Soil formation, *Soil-water-plant relationships, Soil

horizons, Soil investigations, Soil profiles, River basins, Rivers, Alluvium, Flood plains, Deposition(Sediments), Soil texture, Calcium, Organic matter, Nitrogen, Phosphorus, Potassium, Salinity, Irrigation.
Identifiers: *Diyala Basin(Iraq).

Soil and hydrological studies were made in an area of about 125 hectares in the Diyala basin 8 kilometers northeast of Baghdad. The study revealed the presence of two distinct soil units which are representative of the Diyala-Tigris flood plain. The soils are alluvial, deposited by river and irrigation water of the Diyala and to a lesser extent Tigris rivers, and are part of a transition between high levee soils bordering the Diyala river and the heavy textured depression soils toward the west. The soils are characterized by weak to medium structure with distinct polygonal cracks, especially in the depression area. Soils are calcareous (over 19 percent lime), medium to fine textured (40-60 percent clay), low in organic matter, nitrogen and phosphorus, and medium to high in potassium. At the surface the soil is not saline, but salinity increases with depth. Without an artificial drainage system and special soil water management, the saline groundwater during flood season and under intensive cultivation constitutes a potential danger of salinization. In respect to general land use and soil irrigation capability, the two soil units are classified as class II and III for soils in the depression and high situated areas respectively. (Robinett-Arizona) W76-06580

DRAINAGE AND RECLAMATION PERFORMANCE AT THE IMAM EXPERIMENTAL FIELD IN THE GREATER MUSSAYEB PROJECT, A MONITORING STUDY,

Institute for Applied Research on Natural Resources, Baghdad(Iraq).
For primary bibliographic entry see Field 3C. W76-06581

EFFECT OF SALINIZATION ON CERTAIN SOIL MICROFLORA,

Institute for Applied Research on Natural Resources, Baghdad(Iraq).
For primary bibliographic entry see Field 5C. W76-06582

SURFACE RUNOFF AND ITS EFFECT ON DIFFUSE SALT PRODUCTION FROM MANCOS SHALE MEMBERS,

Utah State University, Logan, Dept. of Civil and Environmental Engineering.
S. L. Ponce, R. H. Hawkins, J. J. Jurinak, G. F. Gifford, and J. R. Riley.
In: Watershed Management, Proceedings, Irrigation and Drainage Division American Society of Civil Engineers, August 11-13, 1975, Logan, Utah, p. 140-168. n.d. 10 fig, 13 tab, 9 ref.

Descriptors: *Surface runoff, *Soil chemical properties, *Salinity, *Shales, *Geologic formations, Vegetation effects, Alkalinity, Water quality, Utah, Colorado River Basin, Alluvium, Soil types, Precipitation(Atmospheric), Rainfall-runoff relationships, Electrical conductance.
Identifiers: *Price River Basin(Utah).

A study was done within the Price River Basin, one of the major sources of salinity to the Colorado River, located in east-central Utah. Results indicated that alluvial deposits very near the channel of a perennial stream tend to yield runoff water of high salinity. The Blue Gate and Mancos undivided shale members are the prime salt producers in the basin. No simple relation was found between soil salinity and salinity of the runoff water over the soil. A slight correlation was noted between geologic type and the ratio of surface runoff to precipitation, while hydrologic soil-complex numbers showed no distinct separation between types. Strong linear relations exist

between electrical conductivity and Ca^{++} and SO_4^{--} while poor correlations exist between the ratio of surface runoff to precipitation and surface runoff to total solids for runoff from the Mancos members. (Robinet-Arizona)
W76-06583

INFLUENCE OF VESICULAR HORIZONS ON WATERSHED MANAGEMENT,
Texas A and M Univ., College Station. Dept. of Range Science.
For primary bibliographic entry see Field 4D.
W76-06596

IDENTIFICATION AND TREATMENT OF DISPERSIVE CLAY SOILS,
Oklahoma State Univ., Stillwater. School of Civil Engineering.
For primary bibliographic entry see Field 8D.
W76-06611

STABILIZATION OF CLAY SOILS AGAINST EROSION LOSS,
Purdue Univ., Lafayette, Ind. School of Civil Engineering.
For primary bibliographic entry see Field 4D.
W76-06640

CHEMICAL/BIOLOGICAL RELATIONSHIPS RELEVANT TO ECOLOGICAL EFFECTS OF ACID RAINFALL,
National Ecological Research Lab., Corvallis, Oreg.
For primary bibliographic entry see Field 5A.
W76-06650

CORRELATION OF DUAL-CHANNEL AIRBORNE IR DATA WITH SOIL MOISTURE MEASUREMENTS,
Development and Resources Transportation Co., Silver Spring, Md.
L. A. LeSchack, N. K. Del Grande, S. I. Outcalt, J. Lewis, and C. Jenner.
Final Report, May 1975. 64 p, 11 fig, 11 tab, 29 ref, 4 append. Contr. 4-35308.

Descriptors: *Soils, *Soil moisture, *Soil temperature, *Moisture, *Temperature, *Infrared radiation, *Statistics, *Statistical methods, *Statistical models, *Regression analysis, *Correlation analysis.
Identifiers: Soil radiant emittance, Soil moisture data, Infrared airborne data, Cluster analysis.

To show that a positive correlation existed among the soil-moisture-radiant emittance data, cluster analysis was used to divide the raw radiant emittance data into two distinct groups. Regression analysis thereupon showed significant positive correlations. Corrected surface temperature data were compared with calculated values obtained using a Digital Surface-Climate Simulator Model. Additionally, a 'Student Paired-t Test' showed that both observed and simulated temperature data came from the same statistical population. The implication is that the model is a useful tool for estimating the effect of soil moisture on the energy radiated from the surface. (NOAA)
W76-06660

SOIL MOISTURE SURVEY EXPERIMENT AT LUTERNE MINNESOTA, DATE OF SURVEY: MAY 12, 1975,
EG and G, Inc., Las Vegas, Nev.
E. L. Feimster, and A. E. Fritzsche.
Report EGG-1183-1675, November 1975. 29 p, 7 fig, 6 tab, 2 ref, 2 append. NOAA Cont. no. 31-USC-686.

Descriptors: *Surveys, *Moisture, Soil moisture, *Moisture content, Gamma rays, Remote sensing, Electromagnetic waves, Data collections, Measurements, *Minnesota.

Identifiers: *Soil moisture survey, *Gamma radiation, Terrestrial gamma flux attenuation.

Results are presented of an aerial survey employing the measurement of natural terrestrial gamma radiation carried out over farm lands south of Luterne, Minnesota on May 12, 1975. The purpose of the survey was to determine soil moisture content. During the survey, soil moisture values were computed from airborne gamma data collected over five flight lines and compared to data collected over these same lines during a similar survey of March 6, 1973. These soil moistures were compared to soil moistures computed gravimetrically from soil samples taken along flight lines during the last survey. The results indicate very good agreement between the aerial and the ground measured soil moistures. The average soil moisture values for the 8-mi long survey lines derived from these aerial measurements were in good agreement with results from ground based soil sampling. Mile-by-mile averages of the aerial data ranged from 21 to 36% for Line A with an average of 27%. This compares well to the ground based soil moisture values ranging from 23 to 29% with an average of 28%. (NOAA)
W76-06663

SOIL MOISTURE SURVEY EXPERIMENT AT PHOENIX, ARIZONA, DATE OF SURVEY: MARCH 18, 1975,
EG and G, Inc., Las Vegas, Nev.
E. L. Feimster, A. E. Fritzsche, and C. Jupiter.
Rpt. No. EGG-1183-1674, November 1975. 29 p, 5 fig, 6 tab, append. NOAA Contract no. 31-USC-686.

Descriptors: *Surveys, *Moisture, *Soil moisture, Moisture content, Electromagnetic waves, Gamma rays, Remote sensing, Data collections, Measurements, *Arizona.
Identifiers: *Aerial surveys, *Soil moisture survey, Gamma radiation, Terrestrial gamma flux attenuation, Phoenix(Ariz).

An aerial survey employing the measurement of natural terrestrial gamma radiation was carried out over farm lands east of Phoenix, Arizona, on March 18, 1975. The purpose of the survey was to determine soil moisture by detecting differences in the terrestrial gamma flux attenuation as a function of soil moisture content. The average soil moisture value for the 16-mile long survey line 1, derived from these aerial measurements was 21.56%. Mile-by-mile averages of the aerial data ranged from 16.6% to 32.2%. This survey was carried out in order to offer an independent method of validating soil moisture data derived from aerial microwave and infrared measurements performed by the National Aeronautics and Space Administration. (NOAA)
W76-06664

THE RATE OF SPREAD OF FUEL OIL NO. 1,
Geological Survey of Sweden, Stockholm.
For primary bibliographic entry see Field 5B.
W76-06677

CHARACTERIZING THE SOIL MOISTURE DYNAMICS OF LOESS-BRAUNSTAUGLEY SOILS IN THE LOESS LOAM HILLY TRACT OF NORTHWEST SAXONY, (IN GERMAN),
J. Clausnitzer.
Arch Acker-Pflanzenbau Bodenkd 19(5); p. 337-346, 1975.

Descriptors: *Soil moisture, Europe, Loam, Soils, Loess, Climates, Soil horizons.
Identifiers: *Soil depth, E. Germany.

Soil moisture variations and thus also the occurrence of wet and dry stages strongly depend on weather conditions. During the vegetation period soil moisture variations decline with soil depth. Analysis of the soil moisture suction relations

revealed that Loss-Braunstaugley soils dry out almost continuously from the top to the greater depths. A specific exhaustion coefficient shows that the differences in the soil moisture dynamics of the Loss-Braunstaugley soils cannot be explained by the differences in the sequence of horizons.—Copyright 1975, Biological Abstracts, Inc.
W76-06726

STUDIES ON THE EFFECT OF SOIL DENSITY, TEMPERATURE AND FERTILIZATION OF THE SOIL MOISTURE, VALUE OBTAINED WITH A DIELECTRIC MEASURING TECHNIQUE, (IN GERMAN),
W. Baehin.
Arch Ackerpflanzenbau Bodenkd 19 (5); p. 355-364, 1975.

Descriptors: *Soil density, *Soil temperature, *Soil moisture, Measurements, Saline soils, Salinity, Fertilization, Fertilizers, Leaching, Instrumentation.

Model experiments were carried out with 4 different soils to test the soil moisture measuring instrument (working on the basis of the dielectric constant) of Sprigade. The effect of soil density, soil temperature and soil salinity on the measured values was determined. The effect of soil density was relatively small. Big errors of measurement were due to soil temperature variations which led to changes of soil conductivity. Because of its magnitude, this error cannot be neglected or sufficiently corrected. The measured value was influenced most strongly by the continuously changing soil conductivity resulting from continuously varying ion concentrations as a result of fertilization, leaching and extration by plants as well as of varying soil moisture. The values obtained with K and N fertilizers on soils of a low exchange capacity were particularly unfavorable.—Copyright 1975, Biological Abstracts, Inc.
W76-06727

WATER ECONOMY OF A SOIL ON WEATHERED GRANITE UNDER A SPRUCE GROVE, (IN FRENCH),
Paris-7 Univ. (France). Lab. of Biogeography.
C. Vallee, and A. Feodorff.
Bull Assoc Fr Etude Sol 2; p. 119-131, 1974.

Descriptors: Weathering, Spruce, Soils, Soil moisture, Soil water, Granite.

To determine the possible influence of deforestation on the water economy of the Morvan granitic soils, 2 neighboring sites, one under spruces and the other within a recent cutting were submitted to periodic humidity measurements and continuous soil moisture stress recording at 2 levels for 2 yr. Differences were observed in the consumption of the soil water reserve of the 2 sites. It was much lower under the cutting than under the spruce grove.—Copyright 1975, Biological Abstracts, Inc.
W76-06728

INFLUENCE OF WATERLOGGING ON MICROBIAL MINERAL WEATHERING, (IN FRENCH),
Centre National de la Recherche Scientifique, Vandoeuvre-les-Nancy (France). Centre de Pedologie Biologique.
For primary bibliographic entry see Field 5C.
W76-06730

EFFECTS OF SOIL MOISTURE ON GROWTH OF JAPANESE RABDOSIA, (IN JAPANESE),
For primary bibliographic entry see Field 21.
W76-06771

Field 2—WATER CYCLE

Group 2G—Water In Soils

IRRIGATION OF FIELD TOMATOES AND MEASUREMENT OF SOIL WATER CHANGES BY NEUTRON MODERATION METHODS. California Univ., Riverside. Dept. of Soil Science and Agricultural Engineering.
For primary bibliographic entry see Field 3F.
W76-06793

2H. Lakes

THE WATER FAUNA OF THE HIGH MOUNTAIN GLACIER LAKES IN THE MANDARAS VALLEY IN THE HIGH HINDU KUSH, (IN POLISH). Jagellonian Univ., Krakow (Poland). Instytut Zoologii Systematics; and Jagellonian Univ., Krakow (Poland). Instytut Zoogeography.
For primary bibliographic entry see Field 5C.
W76-06166

LEVEL OF CLOSED BODIES OF WATER AS ONE OF THE CRITERIA OF GLOBAL WATER EXCHANGE. Akademiya Nauk SSSR, Moscow. Institut Vodnykh Problem.
For primary bibliographic entry see Field 2A.
W76-06179

THE BIOGEOCHEMISTRY OF PHOSPHORUS IN AN EXPERIMENTAL LAKE ENVIRONMENT: EVIDENCE FOR THE FORMATION OF HUMIC-METAL-PHOSPHATE COMPLEXES. Fisheries Research Board of Canada, Winnipeg (Manitoba). Freshwater Inst.
For primary bibliographic entry see Field 5C.
W76-06203

THE PHYTOPLANKTON AND PRIMARY PRODUCTIVITY OF SOUTHERN INDIAN LAKE (MANITOBA), A HIGH LATITUDE, RIVERINE LAKE. Fisheries Research Board of Canada, Winnipeg (Manitoba). Freshwater Inst.
For primary bibliographic entry see Field 5C.
W76-06204

WATER CHEMISTRY AND FERTILITY OF TWENTY-THREE CONNECTICUT LAKES. Connecticut Agricultural Experiment Station, New Haven.
For primary bibliographic entry see Field 5C.
W76-06207

CHANGES IN WATER QUALITY IN FINNISH LAKES AND RIVERS 1962-1973 (IN FINNISH WITH ENGLISH SUMMARY). National Water Board of Finland, Helsinki. Research Inst.
For primary bibliographic entry see Field 5C.
W76-06212

A COMPARATIVE STUDY OF CHEMICAL LOADINGS OF ACID AND NON-ACID TRIBUTARIES OF CHEAT LAKE, WEST VIRGINIA. West Virginia Univ., Morgantown. Dept. of Biology.
For primary bibliographic entry see Field 5B.
W76-06213

THE PLANKTONIC CRUSTACEANS OF MONCOVE LAKE, MONROE COUNTY, W. VA. Arizona State Univ., Tempe. Dept. of Zoology.
For primary bibliographic entry see Field 5C.
W76-06214

THE RELATIONSHIPS OF PHOSPHORUS AND NITROGEN TO THE TROPHIC STATE OF

NORTHEAST AND NORTH-CENTRAL LAKES AND RESERVOIRS. Pacific Northwest Environmental Research Lab., Corvallis, Oreg.
For primary bibliographic entry see Field 5C.
W76-06220

NATIONAL EUTROPHICATION SURVEY METHODS FOR LAKES SAMPLED IN 1972. Pacific Northwest Environmental Research Lab., Corvallis, Oreg.
For primary bibliographic entry see Field 5C.
W76-06221

PHYTOPLANKTON BIOMASS AND DISTRIBUTION IN A SHALLOW EUTROPHIC LAKE (LAKE GEORGE, UGANDA). Vienna Univ. (Austria). Limnologische Lehrkanzel.
For primary bibliographic entry see Field 5C.
W76-06246

N AND P DISTRIBUTION IN LAKE KINNERET (ISRAEL) WITH EMPHASIS ON DISSOLVED ORGANIC NITROGEN. Israel Oceanographic and Limnological Research Ltd., Haifa; and Kinneret Limnology Lab., Tiberias (Israel).
For primary bibliographic entry see Field 5B.
W76-06268

PRODUCTION OF PLANKTONIC CRUSTACEANS OF TWO SECONDARY OLIGOTROPHIC LAKES, (IN RUSSIAN). Gorki State Univ. (USSR).
For primary bibliographic entry see Field 5C.
W76-06301

TRANSMISSOMETER MEASUREMENTS OF THE GREAT LAKES. Canada Centre for Inland Waters, Burlington (Ontario).
For primary bibliographic entry see Field 7B.
W76-06370

WAVE FORCES ON BOTTOM-MOUNTED LARGE-DIAMETER CYLINDER. Naval Postgraduate School, Monterey, Calif. Dept. of Mechanical Engineering.
For primary bibliographic entry see Field 8B.
W76-06395

RELEASE CONTROL POLICY FOR A LARGE LAKE SUBJECT TO WIND WAVES. Water Resources Center, Budapest (Hungary).
For primary bibliographic entry see Field 4A.
W76-06421

DYNAMICS OF MARSH LAND FORMATION AND SUCCESSION ALONG THE LOWER COLORADO RIVER AND THEIR IMPORTANCE AND MANAGEMENT PROBLEMS AS RELATED TO WILDLIFE IN THE ARID SOUTHWEST. Arizona State Univ., Tempe.
For primary bibliographic entry see Field 4A.
W76-06589

LAKE LOCATION AND QUALITY AS DETERMINANTS OF POTENTIAL RECREATION BENEFITS: A STUDY OF SELECTED LAKES IN MANITOBA. Manitoba Univ., Winnipeg. Dept. of Agricultural Economics and Farm Management.
For primary bibliographic entry see Field 6B.
W76-06622

A GUIDE TO WISCONSIN'S LAKE MANAGEMENT LAW. Wisconsin Univ. Extension, Madison.
For primary bibliographic entry see Field 6E.
W76-06632

LAKE MANAGEMENT CONFERENCE, MAY 12-14, 1975. Purdue Univ., Lafayette, Ind. Water Resources Research Center.
For primary bibliographic entry see Field 4A.
W76-06642

LAKE HURON BEGINNING-OF-MONTH WATER LEVELS AND MONTHLY RATES OF CHANGE OF STORAGE. National Oceanic and Atmospheric Administration, Boulder, Colo. Environmental Research Labs.
F. H. Quinn.
For sale by the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402. NOAA TR ERL 348-GLERL 4, GLERL Contribution No. 34, July 1975. 27 p, 6 fig, 15 tab, 1 ref, append.

Descriptors: *Water levels, *Water storage, *Water level fluctuations, Gages, Gaging stations, Height, Lakes, *Lake Huron, Great Lakes, Networks.
Identifiers: Rates of change of storage, Changes of storage, Beginning-of-month water levels, *Gage network.

Results are described of a study of Lake Huron beginning-of-month water levels and monthly changes of storage. The study established that the number and distribution of water level gages in the presently existing gage network is adequate for the computation of beginning-of-month water levels. Computed beginning-of-month water levels and changes of storage for the period 1900-1937 are listed. (NOAA)
W76-06657

OPERATIONAL CHARACTERISTICS OF THE DECCA LAMBDA (6F) POSITIONING SYSTEM OVER FRESH WATER. Canadian Hydrographic Service, Ottawa (Ontario).
For primary bibliographic entry see Field 7B.
W76-06662

THE EFFECTS OF A BENTHIC GRAZER ON THE PRIMARY PRODUCTIVITY OF THE LITTORAL ZONE OF LAKE TAHOE. California Univ., Davis. Div. of Environmental Studies.
For primary bibliographic entry see Field 5C.
W76-06719

STUDY OF THE STRONTIUM 90/STRONTIUM ISOTOPE BALANCE IN A LATVIAN LAKE, (IN RUSSIAN). Akademiya Nauk Latvinskoi SSR, Riga. Inst. of Biology.
For primary bibliographic entry see Field 5A.
W76-06733

ON THE UNIVERSALITY OF THE POOLE AND ATKINS SECCHI DISK-LIGHT EXTINCTION EQUATION. Agricultural Research Service, Phoenix, Ariz. Water Conservation Lab.
For primary bibliographic entry see Field 5A.
W76-06737

PHOTOSYNTHETIC RATES OF PHYTOPLANKTON IN EAST AFRICAN ALKALINE, SALINE LAKES. Duke Univ., Durham, N. C. Dept. of Zoology.
For primary bibliographic entry see Field 5C.

W76-06742

A TEMPERATURE-STRESSED STREAM ECOSYSTEM BELOW A HYPOLIMNIAL RELEASE MOUNTAIN RESERVOIR, Colorado State Univ., Fort Collins. Dept. of Zoology; and Colorado State Univ., Fort Collins. Dept. of Entomology.

For primary bibliographic entry see Field 5C.
W76-06743

A STUDY OF THE BENTHIC MACRO-INVERTEBRATES OF A SHALLOW EUTROPHIC RESERVOIR IN SOUTH WALES WITH EMPHASIS ON THE CHIRONOMIDAE (DIPTERA); THEIR LIFE HISTORIES AND PRODUCTION, University of Wales Inst. of Science and Technology, Cardiff. Dept. of Applied Biology.

For primary bibliographic entry see Field 5C.
W76-06747

THE BACTERIAL COMPOSITION, AND THE METABOLIC ACTIVITY OF SOME PHYSIOLOGICAL GROUPS OF BACTERIA IN TWO GRAVEL PIT LAKES, Slovenska Akademie Vied, Bratislava (Czechoslovakia). Limnologisches Institut.

For primary bibliographic entry see Field 5C.
W76-06749

OWASCO LAKE AND ITS WATERSHED, A SUMMARY REPORT WITH TWO APPENDICES AND MAPS, Cornell University, Ithaca, N. Y. Dept. of Natural Resources.

For primary bibliographic entry see Field 5C.
W76-06751

HYDROGRAPHICAL FEATURES OF NORD-BYTTJERNET, A MANGANESE-RICH METAMORPHIC LAKE IN SE NORWAY, Oslo Univ. (Norway). Dept. of Limnology.

For primary bibliographic entry see Field 5C.
W76-06752

NEUTRON ACTIVATION ANALYSIS OF SOME OF THE BIOLOGICALLY ACTIVE TRACE ELEMENTS IN FISH, Pennsylvania State Univ., University Park, Dept. of Nuclear Engineering.

For primary bibliographic entry see Field 5A.
W76-06753

OBSERVATIONS AND EXPERIMENTS ON THE PHYTOPLANKTON OF BLEHAM TARN, ENGLISH LAKE DISTRICT I. THE EXPERIMENTAL TUBES,

For primary bibliographic entry see Field 5C.
W76-06758

A NATURAL HISTORY STUDY OF THE VASCULAR FLORA OF CEDAR BOG, CHAMPAIGN COUNTS, OHIO, Urbana Coll., Ohio. Div. of Scientific Mathematics.

C. M. Frederick.
Ohio J Sci. 74(2), p65-116, 1974.

Descriptors: *Bogs, Vegetation, Ohio, Trees, Climates, Weather, Swamps, Distribution, Temperature.

Identifiers: Mad River(Ohio), Cedar bog.

Cedar Bog Nature Preserve is a relict boreal bog situated in the Mad River valley in Champaign County, west-central Ohio. Originating following the retreat of the Wisconsin glacier, it has been maintained by the combination of a usually cool moist microclimate and a uniform flow of cool

ground water. Microclimatic data recorded from 1963 through 1969 demonstrate that Cedar Bog has cooler temperatures and a shorter frost-free period than do adjoining areas. These 2 factors have resulted in the survival of plants unique to this part of Ohio. Within the Bog area, 6 major plant associations have been identified—the bog meadow, marl meadow, arbor vitae, swamp forest, hardwood forest and shrub associations. The marl meadow (the wettest area) lies in the northeast section, with the bog meadow and arbor vitae associations south of it, the swamp forest occurring adjacent to the arbor vitae, on the west and the hardwood forest lying beyond the swamp forest. A total of 546 taxa of vascular plants was identified in the Bog; this list is presented, together with information on occurrence, abundance, and whether or not the species has been reported earlier. Of these taxa, 173 were previously unreported for Cedar Bog, whereas twenty-one with earlier documented occurrences are now apparently extinct in the Bog. —Copyright 1975, Biological Abstracts, Inc.

W76-06760

VEGETATION CHANGES IN A SMALL MICHIGAN BOG FROM 1917 TO 1972, Wisconsin Univ., Green Bay. Coll. of Environmental Sciences.

C. R. Schwintzer, and G. Williams.
Am Midl Nat. 92(2), p 447-459, 1974.

Descriptors: *Bogs, *Vegetation, Trees, Weather, Climates, Flooding, Michigan, Mortality.

Identifiers: Chamaedaphne, Bryants bog(Mich).

Quantitative descriptions of the vegetation and maps of the pool of Bryant's Bog are available for several years since 1917. The vegetation advanced into the bog pool in an irregular manner at an average rate of 2.1 cm/yr. In 1972 the pool was 76% of its extent in 1926. The vegetation changed in a successional series from the Chamaedaphne association of 1917 to the high bog-shrub association in the dry years of the 1920's to a bog forest which was well established in the late 1960's. It regressed in the early 1970's when many of the trees died and the Chamaedaphne association appeared to be re-establishing itself. The most probable cause of tree mortality was flooding caused by exceptionally high water levels due to natural weather cycles. Tree mortality was also found in Hoop Lake Bog—which, like Bryant's Bog, lacks aboveground drainage—while none occurred in bogs with above ground drainage.—Copyright 1975, Biological Abstracts, Inc.

W76-06761

LAKE ELLESMERE, CANTERBURY, NEW ZEALAND: A REVIEW OF THE LAKE AND ITS CATCHMENT,

Department of Scientific and Industrial Research, Lower Hutt (New Zealand). Ecology Div.

For primary bibliographic entry see Field 5C.
W76-06762

ICTALURUS NEBULOSUS (LE SUEUR, 1819) IN A LAKE BIOCENOSIS, (IN POLISH), Akademia Rolnicza, Lublin (Poland). Instytut Biologii.

L. H. Adamczyk.
Przegl Zool 19(1), p 71-73, 1975.

Descriptors: Lakes, *Bullheads, Fish.

Identifiers: *Biocenosis(Lakes).

The changes in a lake biocenosis after the invasion of *I. nebulosus* (Le Sueur, 1819) are described.—Copyright 1975, Biological Abstracts, Inc.

W76-06765

CHLOROPHYLL A CONTENT AS AN INDEX OF PERIPHYTON PRODUCTIVITY, EXEMPLIFIED BY LAKE KRASNOE, (IN RUSSIAN),

For primary bibliographic entry see Field 5A.

W76-06772

THE MICROFLORA OF AEROBIC BACTERIA IN GRAVEL PIT LAKES, (IN GERMAN), Sueddeutsche Versuchs- und Forschungsanstalt fuer Milchwirtschaft, Weihenstephan (West Germany). Bakteriologisches Institut.

For primary bibliographic entry see Field 5C.
W76-06777

HORIZONTAL DISTRIBUTION OF ZOOPLANKTON IN THE MINGECHAUR RESERVOIR, (IN RUSSIAN),

I. A. Akhmedov.
Izv Akad Nauk Az SSR ser Biol Nauk 5-6, p 106-111, 1974.

Descriptors: Zooplankton, Reservoirs, Distribution patterns, Spatial distribution, Algae, Fish.

Identifiers: Azerbaijan-SSR, *USSR(Mingeaur Reservoir).

Investigations in 1965-1970 established that a number of species of zooplankton have a wide horizontal distribution in the Mingechaur Reservoir on the Kura River in the Azerbaizhan SSR (USSR). In the upper stretch of the reservoir 26 spp. were found; in the middle stretch, 29 spp.; in the lower stretch, 25 spp.; and in the Khanabad stretch near the dam, 15 spp. The seasonal distribution of zooplankton in the reservoir has 2 phases: winter and spring, with maximum biomass in the middle stretch and the minimum in the lower and Khanabad stretches, and summer and fall, with maximum development in the upper stretch. The nonuniform distribution of zooplankton in the reservoir depends on the water level, transparency, thermal regime, wind direction, current velocity, development of algae and consumption of zooplankton by fish.—Copyright 1975, Biological Abstracts, Inc.

W76-06780

VEGETATION IN LAKE TAMNAREN: INTERPRETATION OF AERIAL PHOTOS AND DESCRIPTION OF THE VEGETATION, (IN SWEDISH), Uppsala Univ. (Sweden). Inst. of Limnology.

M. Wallsten.
Sven Bot Tidskr 68(4), p 431-440, 1974.

Descriptors: *Remote sensing, Aerial photography, Lakes, *Vegetation, *Distribution, Aquatic plants.

Identifiers: Elodea-Canadensis, Macrophyte, Nuphar-luteum, Phragmites-communis, Potamogeton-Natans, Scirpus-Lacustris, *Sweden(Lake Tamnaren).

Lake Tamnaren, a shallow lake with an average depth of 0.9 m and a maximum depth of 1.8 m, is situated about 65 km NNW of Uppsala central Sweden. The area of the lake is 38 km², of which L. Sorsjon, and almost separated bay, occupies 3 km². The surface of L. Tamnaren was lowered in 1875 and 1950, resulting in a level 1.5 m below the original. This has caused a vigorous growth of the vegetation. Aerial photography of the lake was carried out in the summer of 1973 and mapping done with the help of the pictures. Each stand of vegetation was dominated by a single species. *Phragmites communis* Trin. and *Scirpus lacustris* L. were the most common species along the shores. Towards the middle of the lake these stands were succeeded by a belt of floating-leaved vegetation with *Nuphar luteum* (L.) Sm. and *Potamogeton natans* L. The distribution areas of the plants were measured using a photoelectric method. The total area of the aquatic macrovegetation is 30.7 km², which means that all of L. Sorsjon and 79% of L. Tamnaren were covered with vegetation. It was not possible to record sparsely scattered plants and submerged vegetation. In some parts *Elodea canadensis* Michx. was very abundant.

W76-06781

Field 2—WATER CYCLE

Group 2H—Lakes

CONTINUOUS CULTURES APPLIED TO ECOLOGICAL RESEARCH, (IN FRENCH), Institut National de la Recherche Agronomique, Thonon-les-Bains (France). Station d'Hydrobiologie Lacustre.
For primary bibliographic entry see Field 5C.
W76-06782

STUDY OF THE PHOSPHATE METABOLISM OF A DRINKING WATER RESERVOIR, (IN GERMAN),
For primary bibliographic entry see Field 5C.
W76-06785

2I. Water In Plants

THE ORIGIN AND DEVELOPMENT OF WATERLOGGED MEADOWS IN THE CENTRAL PART OF THE SUMAVA FOOTHILLS, Československá Akademie Věd, Brno. Botanická Ústav.
K. Rybníček, and E. Rybníková.
Folia Geobot Phytotaxon. 9(1): 45-70. 1974.

Descriptors: *Europe, Lakes, Sediments, *Grasslands, Biological communities, Ecology, Plant populations, Profiles, Distribution patterns.
Identifiers: Czechoslovakia, Foothills, Lake Holocene, Meadows, Lake Flandrian, Sumava.

The paleoecological investigation of the meadows (Czechoslovakia) is based on the macroscopic analyses, completed with pollen analyses, of Late Holocene (Lake Flandrian) sediments in 5 profiles. It is suggested that, in the course of the last 600-700 yr, the meadows developed as a secondary plant community, replacing original alder stands, due to the activity of man in the area; they usually passed through seminatural meadow types to the present cultivated stands. In addition to detailed descriptions of local successions on various sites, the study presents some general conclusions concerning the cenotic and synecological adaptability of some plants, discusses the development of plant communities and their changes in time.—Copyright 1974, Biological Abstracts, Inc.
W76-06247

WATER RELATIONS OF SELECTED SPECIES OF CHAPARRAL AND COASTAL SAGE COMMUNITIES, San Diego State Univ., Calif. Dept. of Biology.
For primary bibliographic entry see Field 3B.
W76-06259

SEED GERMINATION, RESPIRATION AND MITOCHONDRIAL EFFICIENCY OF THREE ALFALFA (MEDICAGO SATIVA L.) CULTIVARS SUBJECTED TO NaCl SALINITY, Arizona Univ., Tucson. Dept. of Agronomy and Plant Genetics.
For primary bibliographic entry see Field 3C.
W76-06264

EFFECT OF SALINE WATER IRRIGATION ON N.CO310 AND H50-7209 CULTIVARS OF SUGARCANE: II. CHEMICAL COMPOSITION OF PLANTS, Hawaii Univ., Honolulu. Dept. of Agronomy and Soil Science.
For primary bibliographic entry see Field 3C.
W76-06274

THE DISTRIBUTIONAL ECOLOGY AND DIVERSITY OF BENTHIC INSECTS IN CEMENT CREEK, COLORADO, Maryland Univ., College Park. Md. Dept. of Zoology.
J. D. Allan.
Ecology, Vol. 56, No. 5, p 1040-1053, Late Summer, 1975. 9 fig, 8 tab, 54 ref.

Descriptors: *Ecological distribution, *Spatial distribution, Benthic fauna, Streams, *Ecotypes, *Aquatic insects, Ecology, Biological communities, Predation, Water temperature, Biota, Environmental gradient, *Colorado, Elevation.
Identifiers: *Cement Creek(Colo), Diversity, *Benthic insects.

Streams exhibit longitudinal zonation in such factors as temperature, current, substratum, and biota. Several levels of spatial scale were studied in the alpine stream Cement Creek in Gunnison County, Colorado. Faunal replacement did not appear to be affected by ecotones including zonation in terrestrial vegetation and trout distribution, but did seem to be associated with gradual changes in the physical gradient. Trout zonation may affect total number of insects, as the trout-free headwaters had two to six times higher insect densities. Investigation of microdistribution led to the hypothesis that increased substratum complexity leads to greater species richness based on several lines of evidence: (1) different species showed different substratum preferences, (2) colonization of mixed substrata generally resulted in greater mean species richness than did colonization of a single substratum type, and (3) both species diversity and substratum complexity were greatest at the within-microhabitat level. Substratum composition showed little variation along the elevational gradient and did not appear to be a cause of faunal replacement. (Robinet-Arizona)
W76-06587

SALT CEDAR (TAMARIX CHINENSIS) SEED PRODUCTION, SEEDLING ESTABLISHMENT, AND RESPONSE TO INUNDATION, Geological Survey, Tucson, Ariz.
For primary bibliographic entry see Field 3B.
W76-06590

LOCALIZATION OF DAMAGE INCURRED DURING WATER IMBIBITION BY PISUM SATIVUM AND ZEA MAYS SEEDS, AS REVEALED BY THE TOPOGRAPHIC TETRAZOLIUM TEST, Scottish Horticultural Research Inst., Invergowrie.
J. G. Harrison.
Hortic Res. 13(2/3), p 119-124, 1973.

Descriptors: *Seeds, *Root zone, *Corn(Field), Inhibition, Plant physiology.
Identifiers: *Pisum-Sativum, *Tetrazolium test.

Damage incurred when seeds of *P. sativum* L. and *Z. mays* L. were soaked in water reduced their viability. More died after imbibition at 1 C than after imbibition at 20 C. The standard topographic tetrazolium test showed that loss of viability was associated with death of the root and shoot tips of the embryo.—Copyright 1974, Biological Abstracts, Inc.
W76-06649

INLAND WATERS, SPECIFIC PRESENTATIONS FROM LIMNOLOGY AND RELATED FIELDS, VOL. 27. THE REED PHRAGMITES COMMUNIS TRINIUS, (IN GERMAN), L. Rodewald-Rudescu.
302 p. E. Schweizerbart'sche Verlagsbuchhandlung: Stuttgart, West Germany. 1974.

Descriptors: *Reeds, *Inland waterways, limnology, Systematics, History, Plant physiology, Publications, Distribution, Drought, Aquatic plants, Microorganisms.
Identifiers: *Phragmites-Communis.

The general systematics, distribution, history, morphology and macro- and micro- scopical anatomy of reeds are discussed. Development, reproduction, O₂ supply, water and material balance and resistance to cold, drought and salt are also covered. Then climate, soil and water

microbiology and chemistry, flora and fauna of Phragmites crops, chemical properties with respect to paper production and classification according to biotype are discussed. Finally, methods of reed cultivation, nutrient solutions, morphological, anatomical and physiological changes due to cultivation, mechanical harvesting, storage, damage and the broad significance of reeds in industry are examined.—Copyright 1975, Biological Abstracts, Inc.
W76-06741

WATER PLANTS OF THE WORLD. A MANUAL FOR THE IDENTIFICATION OF THE GENERA OF FRESHWATER MACROPHYTES, C. D. K. Cook, B. J. Gut, E. M. Rix, J. Schneller, and M. Seitz.
561p. Dr. W. Junk b.v., Publishers: The Hague, Netherlands. 1974.

Descriptors: *Aquatic plants, Publications, Ecology, Reproduction, *Algae.
Identifiers: Bryophyta, Charophyta, *Macrophytes, Pteridophyta, Spermatophyta.

The Charophyta, Bryophyta, Pteridophyta and Spermatophyta whose photosynthetically active parts are located in freshwater are covered; marine and exclusively brackish water plants are not. Keys to the families based on reproductive features and keys to the genera based on vegetative structures are provided. Most of the text consists of the genera descriptions including morphology, distribution, number of species and ecology. References and synonyms are also included. All genera are illustrated by line-drawings. A glossary and an index to the families and genera are provided.—Copyright 1975, Biological Abstracts, Inc.
W76-06745

ESTIMATION OF THE TOTAL EVAPORATION OF EXPERIMENTAL OBJECTS IN CLIMATIC CHAMBERS, (IN BULGARIAN), Academy of Agricultural Sciences, Sofia (Bulgaria). Central Lab. for Agrophysical Investigations.
For primary bibliographic entry see Field 2D.
W76-06766

PHYTOSOCIOLOGICAL STUDIES OF AQUATIC AND MARSH VEGETATION IN MORE OG ROMSDAL, WESTERN NORWAY, (IN NORWEGIAN),
For primary bibliographic entry see Field 2L.
W76-06767

THE 'RHEINSCHNAKEN' (DIPTERA, CULICIDAE) SPECIES, LIFE STYLE, ECOLOGY, MASS DEVELOPMENT, AND CONTROL, (IN GERMAN), Freie Universitaet Berlin (West Germany). Institut fuer Angewandte Zoologie.
F. Peus.
Z Ange W Zool 62 (2), p 231-242, 1975.

Descriptors: Diptera, Europe, Ecology, Rivers, Forests, *Mosquitoes, Regions.
Identifiers: Aedes-sticticus, Aedes-vexans, *Culicidae, Rheinschnaken, *Rhine River(W Germany).

The regional expression 'Rheinschnaken' refers to the *Aedes vexans* and *A. sticticus* which occasionally occur in large numbers in the lowland forests along the upper Rhine river (West Germany). The large stagnant pools of water formed by stopping off older sections of the river and those formed in the natural basins in the forests are the main breeding areas. The annual cycle of these mosquitoes corresponds closely to the hydrological events in the lowland forests. Floods in spring and midsummer produce 2 generations. The higher the ground water level, the greater the

number of eggs developed. The older sections of the river should be re-integrated into the main stream and the forest basins should also be connected with the river via canals. These measures are preferable to chemical control since no immunity develops and there is no further pollution. The use of repellents is recommended for anyone staying in the area. Large swarms of harmless Chironomidae are often mistaken for mosquitoes by laymen and light traps are somewhat successfully used against them but these are mostly ignored by the mosquitoes.—Copyright 1975, Biological Abstracts, Inc. W76-06768

EFFECTS OF SOIL MOISTURE ON GROWTH OF JAPANESE RABDOSIA, (IN JAPANESE), N. Kurosaki.
Acta Phytotaxon Geobot 26(3/4), p 89-95, 1974.

Descriptors: *Soil moisture, *Growth rates, Growth stages.
Identifiers: *Rabdosia, Rabdosia-effusa, Rabdosia-inflexa, Rabdosia-japonica, Rabdosia-longituba, Rabdosia-shikokiana, Rabdosia-trichocarpa, Rabdosia-umbrosa, *Japan.

Seven species of Rabdosia (*R. effusa*, *R. inflexa*, *R. japonica*, *R. longituba*, *R. shikokiana*, *R. trichocarpa*, *R. umbrosa*) were studied. Growth was measured by shoot length, number of nodes/and leaf size for each cultivation of 53-55 days after the germination. For every species except *R. japonica*, response was similar. The optimum soil moistures were 60% and 80% of maximum water capacity. When cultivated with 40% and 100% water supply, growth was distinctly reduced, and on media with 20% water supply the plants became stunted or often died. In *R. japonica*, the range of optimum soil moisture was 40%-80%. On the media with 20% and 100% water growth was poor. Compared with the vicarious varieties restricted to the Pacific Ocean side, those of Japan Sea elements, *R. shikokiana* var. *occidentalis* and *R. umbrosa* var. *hakusanensis*, tended to have maximum growth on media somewhat higher in soil moisture (80%).—Copyright 1975, Biological Abstracts, Inc. W76-06771

OPTIMAL DISTRIBUTION OF ASSIMILATES DURING LIMITED WATER SUPPLY: A MATHEMATICAL MODEL, (IN RUSSIAN), Akademiya Nauk Estonskoi SSR, Tartu. Institut Fiziki i Astronomii.
K. Moldau.
Eesti Nsv Tead Akad Biol 24(1); p 3-9, 1975.

Descriptors: *Water supply, *Mathematical models, Optimization, *Distribution patterns, Roots, Leaves, *Growth rates, *Reproduction.

For every soil and atmospheric humidity value there exists an optimal distribution of assimilates between roots and leaves which ensures the maximum rate of assimilation in leaves. With a constant growing period and constant water deficit the maximum reproductive yield is guaranteed by sharp transition from vegetative to reproductive growth in an optimal time. Under water stress the optimal length of the reproductive growth period is increased. At maximum reproductive yield the ratio of reproductive mass to the whole biomass of a plant is 0.5, irrespective of water deficit and length of the growing period. The model allows some phenomena of plant adaption of water deficits to be demonstrated.—Copyright 1975, Biological Abstracts, Inc. W76-06786

RELATIONSHIP BETWEEN PLANT RESPIRATION AND WATER METABOLISM, (IN RUSSIAN), Tashkent Agricultural Inst. (USSR).
I. I. Razmaev.

Dokl Vses (Ordena Lenina) Akad S-Kh Nauk Im V I Lenina 4, p 21-22, 1974.

Descriptors: *Respiration, *Plant physiology, *Metabolism, Equations, *Carbon dioxide production, Temperature, Equations.

Analytic treatment of basic plant catabolism ($\text{RCOOH} + \text{O}_2 = \text{CO}_2 + \text{H}_2\text{O} = 2$) is presented providing equations describing the dynamics of CO_2 production in respect to temperature and correlating CO_2 production with the dynamics of water accumulation and transpiration in plant cells to the limit of plant death. The final equation derived suggests that temperature fluctuations within ordinarily encountered limits determine the duration of plant vegetation.—Copyright 1975, Biological Abstracts, Inc. W76-06789

EFFECTS OF ANTITRANSPIRANTS ON DISTRIBUTION AND UTILIZATION OF PHOTOSYNTHATE IN PINUS RESINOSA SEEDLINGS, Ibadan Univ. (Nigeria). Dept. of Botany.
M. O. Olofinboba, T. T. Kozlowski, and P. E. Marshall.
Plant Soil. 40(3), p 619-635, 1974.

Descriptors: *Antitranspirants, *Distribution patterns, *Pine trees, *Seedlings, Sprays.
Identifiers: Carbon-14, Follicote, Keykote, *Photosynthate.

Three-year-old *P. resinosa* Ait. seedlings were exposed to C^{14}O_2 24 h after application of Aqua Gro, CS 6432, or Wilt Pruf antitranspirants; more activity was recovered from treated seedlings than from control seedlings 1 day after exposure to C^{14}O_2 . However, less activity was recovered when seedlings were exposed to C^{14}O_2 11 days after treatment with any antitranspirant except Clear Spray. Clear Spray, Follicote and Keykote reduced accumulation of photosynthate, but their effects diminished with time. They also reduced the rate of loss of currently produced photosynthate, with the utilization effect most pronounced in Follicote-treated seedlings. All antitranspirants tested, except Aqua Gro and CS 6432, initially reduced the rate of conversion of labelled photosynthates into ethanol-insoluble components when treated seedlings were exposed to C^{14}O_2 24 h after antitranspirant application. More labelled ethanol-insoluble components were recovered from antitranspirant-treated seedlings than from controls 14 days after exposure of seedlings to C^{14}O_2 . The type of spray, time between antitranspirant application and exposure to C^{14}O_2 , as well as the time between exposure and seedling harvest, has significant effects on C^{14} assimilation and redistribution of soluble and insoluble assimilates in various plant parts. Many of the observed effects may not have been directly due to the antitranspirants alone but may have been secondary effects caused by antitranspirant-induced changes in photosynthesis and plant water balance.—Copyright 1974, Biological Abstracts, Inc. W76-06792

FLOODING EFFECTS ON LIGHT REFLECTANCE, TRANSMITTANCE, AND ABSORPTANCE OF COTTON (GOSSYPIMUM HIRSUTUM) LEAVES, Agricultural Research Service, Weslaco, Tex.
R. R. Rodriguez, and H. W. Gausman.
J Rio Grande Val Hort Soc. 27, p 81-85, 1973.

Descriptors: *Flooding, *Cotton, *Leaves, *Light, Crop production, Aerial photography, Remote sensing.
Identifiers: *Chlorophyll deficiency.

Leaves from cotton plants flooded for 14 days became yellow (chlorophyll deficient), and their light reflectance was increased in the visible

wavelength region (500 to 750 nm) compared with the green leaves of nonflooded plants. This change in reflectance might provide a basis for the remote sensing (aerial photography or multispectral scanner) determination of flood damage to crops after heavy rains.—Copyright 1974, Biological Abstracts, Inc. W76-06794

INFLUENCE OF WATER STRESS AND GROWTH REGULATOR APPLICATIONS ON SUGAR COMPOSITION OF SOYBEAN LEAVES, Arkansas Univ., Fayetteville. Dept. of Agronomy.
J. T. Cothren, and C. A. Stutte.
Phyton Rev Int Bot Exp. 31(2), p137-143, 1973.

Descriptors: Soybeans, Leaves, Plant physiology, Chromatography, Growth rates, Fertilizers, Crop production.
Identifiers: Chromatography, Fructose, Glucose, Hydrofurfuryl, Phosphonium, Sucrose, Sugar.

Sugars extracted from soybean leaves treated with either tributyl (5-chloro-2 thienyl) phosphonium chloride or tetrahydrofurfuryl isothiocyanate were assayed for total sugar concentration and composition. Total sugars were estimated colorimetrically while glucose, fructose, and sucrose were determined by gas and thin layer chromatography. Chemical treatments under controlled environmental conditions resulted in a decreased relative percentage composition of glucose and fructose and an increase in sucrose. The total sugar concentration in the leaves of field grown 'Davis' soybeans decreased with tetrahydrofurfuryl isothiocyanate treatment. As with the environmentally controlled plants, the relative percentage of glucose and fructose decreased with sucrose increased. This increased relative percentage of sucrose paralleled seed yield increases of 20% in water stressed plants and 15% in the non-water stressed plants when they were chemically treated. There was 118% seed yield increase in 'Davis' soybeans which were irrigated and chemically treated as compared to water stressed, nontreated plants.—Copyright 1974, Biological Abstracts, Inc. W76-06796

2J. Erosion and Sedimentation

FORMATION OF WATER AND SEDIMENT DISCHARGE DURING THE SPRING FLOOD ON A SLOPE AND IN A SMALL GULLY-RAVINE DRAINAGE BASIN, N. I. Drozd, Z. A. Goretskaya, and P. A. Shkryabiy.
Soviet Hydrology Selected Papers, No. 3, p 154-160, 1974. 2 fig, 3 tab. Translated from Transactions of the State Hydrologic Institute (Trudy Gosudarstvennogo Gidrologicheskogo Instituta), No. 210, p 31-39, 1974.

Descriptors: *Runoff, *Erosion, *Sediments, *Snowmelt, Ravines, Gullies, Melt water, Suspended solids, Discharge(Water), Discharge measurement, Snow, Spring, Precipitation(Atmospheric), Sediment discharge, Basins, Watersheds(Basins).
Identifiers: *USSR, *Dnieper River(USSR).

Water erosion produced by meltwater runoff from slopes and small drainage basins of the gully-ravine type is severe in the hills on the right bank of the Dnieper River. Spring runoff is variable and even discontinuous in the course of the day and in individual periods of snow melting. Peak discharges are relatively low, but of considerable volume, frequently exceeding that of flood runoff by many factors. The variations and characteristics of runoff from two elementary drainage basins during the spring flood of 1969 were examined. Water runoff was measured by weirs at the outlet gaging stations of the ravines. The water was sampled for its suspended particle concentra-

Field 2—WATER CYCLE

Group 2J—Erosion and Sedimentation

tion from two to six times a day, mainly in the afternoon. Precipitation, snow depth, the water equivalent of snow, soil freezing, and soil moisture to a depth of 1.0-1.5 m were measured in the drainage basins. The values of the liquid and solid components of runoff varied throughout the spring not only from day to day, but also in the course of the day. The highest hourly runoff was observed in the afternoon, from 12-13 to 17-18 h. The irregularity of meltwater runoff and of sediment discharge in the course of a spring must be taken into account in computing the volume and filtration capacity of earthen erosion control structures. (Sims-ISWS)

W76-06176

SEDIMENT RESERVOIRS IN THE CHANNELS OF SMALL MOUNTAIN RIVERS,

K. F. Artamonov, A. N. Kroschkin, and N. N. Bystrov.

Soviet Hydrology, Selected Papers, No. 3, p 210-213, 1974. 2 fig, 1 tab, 4 ref. Translated from (Hydraulic Engineering and Reclamation), Gidrotekhnika i melioratsiya, No. 6, p 34-37, 1974.

Descriptors: *Sediments, *Suspended solids, *Rivers, Erosion, Sedimentation, Bed load, River beds, Channels, Mountains, Discharge(Water), Sediment discharge.

Identifiers: *Sediment reservoirs.

Sediment reservoirs on small mountain rivers are an effective means for retaining bed-load and partly of suspended load under high sediment discharge conditions. A complex method of computing the silting of the headrace with separate consideration of the formation of the cones of bed- and suspended-load deposits in the zone of the backwater curve is best suited for computing sediment reservoirs in the mountainous reaches of rivers with a bedload discharge of more than 20-30% of total annual solid discharge. In addition to the organization of quarries of construction material in the headrace, an important measure for increasing the service time of a sediment reservoir (in the presence of outlet discharges and the possibility of completely lowering the water level) is washing of the sediment deposits. The effectiveness of washing increases when bed load is retained in small and the suspended load in large sediment reservoirs. To prevent general and local deformations in the trailrace, the threshold of the outlet opening must be raised above the average level of the river flood plain, the foundations of the cut-off wall must be deepened, and the outlet channel must be regulated. (Sims - ISWS)

W76-06177

SOME CHARACTERISTICS OF THE PROCESS OF INCOMPLETE MEANDERING OF THE CHANNEL OF THE UPPER OB' RIVER,

For primary bibliographic entry see Field 4A.

W76-06178

OPTIMUM DREDGED DEPTH IN INLAND WATERWAY,

CACI, Inc., Arlington, Va.

A. B. Hochstein.

Journal of the Waterways, Harbors and Coastal Engineering Division, American Society of Civil Engineers, Vol. 101, No. WW4, Proceedings Paper 11698, p 331-342, November 1975. 4 fig, 2 tab, 4 ref, 2 append.

Descriptors: *Barges, *Channels, *Dredging, Hydrology, Optimization, Open channel flow, Transportation, *Inland waterways, Networks, Rivers, Water levels, Locks, River beds, Economics.

Identifiers: *Channel stabilization, *Waterways, Economic analysis, Tow industry, Optimal channel depth, Economic estimates.

Criteria for optimum depths in the inland waterway network is minimized value of the sum: cost

of tow industry plus cost of waterway structures, in the open rivers mainly cost of dredging. Volume of dredging is estimated by use of the relationship between the most important hydrological and morphological parameters that determine the degree of stability of the riverbed. If extensive dredging is planned, it is necessary to take into account change of hydraulic parameters of the river that will be followed by a lowering of the water level and depths in channels. In the reaches of open river with sufficient large seasonal oscillation of water levels, it is important to calculate the average usable (seasonal or annual) depth and draft on the base of the relationships between water level and controlling depth. The plan described represented a simple solution to the problem of optimal channel depth, useful for planning purposes and economic estimates. (Roberts - ISWS)

W76-06182

SEDIMENTS EXPOSED ON THE SURFACE OF THE ROSS ICE SHELF, ANTARCTICA,

Nebraska Univ., Lincoln. Ross Ice Shelf Project.

For primary bibliographic entry see Field 2C.

W76-06188

DEPOSITIONAL MODELS AND THE SHINARUMP MEMBER AND THE SONSELA SANDSTONE BED OF THE CHINLE FORMATION NORTHEASTERN ARIZONA AND NORTHWESTERN NEW MEXICO,

Arizona Univ., Tucson. Dept. of Geosciences.

A. S. Trevena.

Master of Science Thesis, 1975, 162 p, 43 fig, 12 tab, 74 ref, 4 append.

Descriptors: *Streambeds, *Geomorphology, *Deposition(Sediments), *Model studies, *Geologic formations, Geology, Streams, Sedimentation, Braiding, Graded, Arizona, New Mexico, Beds(Stratigraphic), Fluvial sediments, Rivers, Sediments, Sandstones, Paleohydrology, History.

Identifiers: *Chinle Formation(Ariz - N Mex).

Modern stream deposits are the key to recognizing the distribution of ancient fluvial environments for a better understanding of paleogeography and paleotectonics. Studies in north eastern Arizona and northwestern New Mexico confirm a stream channel origin for the Shinarump Member and the Sonsele Sandstone Bed of the Chinle Formation and show that streams of diverse channel patterns were present in this region during the Late Triassic. In this paper, three stream channel models are developed from published reports of present-day fluvial sedimentation: (1) abundant horizontally stratified and/or structureless coarse sandstone to conglomerate indicate a bed-load, braided stream model; (2) trough cross-stratified sandstone that becomes finer-grained upward characterizes the suspended-load meandering stream model; and (3) streams of intermediate channel pattern are typified by abundant tabular-planar cross-stratification, trough cross-stratification, and horizontal stratification. This study also indicates that reports of present day fluvial deposits and controlled laboratory flume studies can be used to interpret flow conditions of ancient streams. (Robinett-Arizona)

W76-06258

SEDIMENT DATA, CANADIAN RIVERS 1972.

Department of the Environment, Ottawa (Ontario). Applied Hydrology Div.

For primary bibliographic entry see Field 7C.

W76-06376

AN INVESTIGATION OF SUSPENDED MATERIAL CONCENTRATIONS IN EASTERN LONG ISLAND SOUND,

Connecticut Univ., Groton. Dept. of Geology; and Connecticut Univ., Groton. Marine Sciences Inst.

For primary bibliographic entry see Field 2L.

W76-06381

SOLUTION CHEMISTRY, MASS TRANSFER, AND THE APPROACH TO CHEMICAL EQUILIBRIUM IN POROUS CARBONATE ROCKS AND SEDIMENTS,

Illinois Univ., Urbana. Dept. of Geology.

For primary bibliographic entry see Field 2K.

W76-06384

INITIATION OF BED FORMS AND MEANDERS IN COARSE-GRAINED SEDIMENT,

University Coll. of Wales, Aberystwyth. Dept. of Geography.

Geological Society of America Bulletin, Vol. 87, No. 2, p 281-285, February 1976. 6 fig, 1 tab, 24 ref.

Descriptors: *Meanders, *Fluvial sediments, *Channel erosion, River training, *Geomorphology, Streambeds, Sediment transport, On-site investigations, Hydraulics, Flow rates, Bank erosion.

Identifiers: *Bed forms, *River Ystwyth(Wales), Pseudo-meandering model.

Some field observations pertinent to the role of point-bar formation in meander development were reported. Observations were carried out on the River Ystwyth in Wales. Part of the river was artificially straightened in 1864 and restraightened in 1969. The field observations showed that in a straight plane-bed channel in coarse sediment under natural flow conditions, primary transverse bars were rapidly formed during infrequent high flows, and the accompanying flow modifications led to bank erosion. Primary bars were subsequently incorporated as the cores of point-bar complexes, with additional lateral and tail accretion, chute formation, and lesser erosional and sedimentary modifications. The range of natural flows produced a variety of bed forms; therefore, the channel form at any point in time was not strictly attributable to any single controlling discharge, but the broad features of channel development in general relate to the forms of the pseudo-meandering model. A three-phase model of meander development, with these observations exemplifying the first phase, is adequate and useful. (Singh - ISWS)

W76-06385

EROSION ON THE LINE ISLANDS ARCHIPELAGIC APRON: EFFECT OF SMALL-SCALE TOPOGRAPHIC RELIEF,

Scripps Institution of Oceanography, San Diego. Marine Physical Lab.

For primary bibliographic entry see Field 2L.

W76-06386

LOESS IN OHIO IN RELATION TO SEVERAL POSSIBLE SOURCE AREAS: I. PHYSICAL AND CHEMICAL PROPERTIES,

Ohio State Univ., Columbus. Dept. of Agronomy.

E. M. Rutledge, N. Holowaychuk, G. F. Hall, and L. P. Wilding.

Soil Science Society of America Proceedings, Vol. 39, No. 6, p 1125-1132, November-December 1975. 5 fig, 3 tab, 25 ref.

Descriptors: *Loess, *Ohio, *Valleys, Geomorphology, *Chemical properties, *Physical property, Particle size, Soil formation, Paleosols, Age, On-site investigations, Chemical analysis, Distance, Soil profiles, Silts, Clays, Soil horizons. Identifiers: Source areas, *Little Miami River(Ohio), *Scioto River(Ohio), *Muskingum River(Ohio), Peoria loess, Roxanna silt, Loveland silt, Sangamon paleosol, Multiple deposits, Fine earth criterion, Clay-free criterion, Pedogenic data, Alfisols.

Thin loess deposits east of the Little Miami, Scioto, and Muskingum rivers in Ohio were in-

vestigated (1) to test the hypothesis that these river valleys were source areas for the loess that adjoins them, (2) to determine if multiple loess strata occurred within any of the loess deposits, and (3) to approximate, where possible, the geologic age of the loess. The loessial materials were investigated using morphological, chemical, and physical parameters. Particle-size data were expressed on a fine earth and clay-free basis. The fine earth basis was useful in detecting pedogenic development. Clay-free data were used in establishing changes in parent material with depth and, perhaps more importantly, in development of relations between particle-size and distance from proposed source areas. Scioto and Muskingum river valleys were the chief source areas for the loess in the adjoining study areas, but the Little Miami Valley was not the primary source of the loess in the study area adjacent to it. Multiple loess deposits were identified only adjacent to the Muskingum River. All upper loess units were considered to be of comparable age: Late Wisconsin (Peoria Loess). The middle loess adjacent to the Muskingum River was considered to be Farmdale (Roxanna Silt) and the lower loess at the same site was considered to be Loveland loess (Loveland Silt) and contained a well-developed Sangamon paleosol. (See also W76-06400) (Visocky-ISWS) W76-06399

LOESS IN OHIO IN RELATION TO SEVERAL POSSIBLE SOURCE AREAS: II. ELEMENTAL AND MINERALOGICAL COMPOSITION, Ohio State Univ., Columbus, Dept. of Agronomy. E. M. Rutledge, L. P. Wilding, G. F. Hall, and N. Holowaychuk. Soil Science Society of America Proceedings, Vol. 39, No. 6, p 1133-1139, November-December 1975. 2 fig, 1 tab, 11 ref.

Descriptors: *Loess, *Ohio, *Mineralogy, *Weathering, Soil horizons, Clays, Silts, Soil formation, Particle size, Clay minerals, Calcium, Iron, Potassium, Titanium, Soil profiles, Depth, Paleosols, Quartz, Kaolinite, On-site investigations, Chemical analysis. Identifiers: *Clay fractions, *Muskingum River(Ohio), *Little Miami River(Ohio), *Scioto River(Ohio), Mica, Vermiculite, Zirconium.

This study presents the elemental and mineralogical composition of thin loessial deposits eastward of three rivers in Ohio. In general, elemental contents (Ca, Fe, K, Ti, and Zr) of medium and coarse silts of the Late Wisconsin-age loesses were of the same magnitude in each area. These elements show remarkably slight weathering profiles which were essentially comparable among areas. Weathering profiles of Fe were more strongly expressed than those of K and Ca depth-distribution of Zr and Ti were most uniform. Contents of Ca within a Loveland loess paleosol were remarkable constant in depth and notably low, especially in the coarse silt fraction (mean of 0.06%). Mineralogy did not reflect bedrock lithologies among the different assumed loess areas. Clay fractions from the parent loess in the first two transects were dominated by mica followed by vermiculite and quartz with less expandable and kaolinite. Clay fractions of surface and subsurface horizons in these transects contained about equal amounts of mica, vermiculite, and quartz with less expandables and kaolinite. In the third transect, weathered loessial materials generally contained less mica and more interstratified 10-14 angstrom components. Clay-free particle-size distribution was the most sensitive parameter of parent material uniformity; total Zr and Ti in silt fractions, and Ti/Zr ratios were less sensitive in that order. (See also W76-06399) (Visocky-ISWS) W76-06400

LARGE WAVE TANK TESTS OF RIPRAP STABILITY, Coastal Engineering Research Center, Fort Belvoir, Va. For primary bibliographic entry see Field 8B.

W76-06410

WATER RESOURCES DATA FOR GEORGIA, WATER YEAR 1975, Geological Survey, Doraville, Ga. For primary bibliographic entry see Field 7C. W76-06451

EROSION AND SEDIMENT TRANSPORT IN THE OWENS RIVER NEAR BISHOP, CALIFORNIA, Geological Survey, Menlo Park, Calif. R. P. Williams. Available from National Technical Information Service, Springfield, Va 22161 as PB-251 109/As, \$4.50 in paper copy, \$2.25 in microfiche. Water-Resources Investigations 49-75, December 1975. 49 p, 22 fig, 9 tab, 26 ref.

Descriptors: *Bank erosion, *Sediment transport, *Erosion rates, *Reservoir releases, *Fisheries, *California, Ecosystems, Brown trout, Sediments, Particle size, Streams, Streamflow, Bed load, Channel erosion, Channel morphology, Data collections, Evaluation, Postimpoundment. Identifiers: *Owens River(Calif), Pleasant Valley Dam(Calif).

The Owens River near Bishop supports one of the outstanding brown trout fisheries in California. The brown trout prefer to spawn in gravel approximately 0.75 in in diameter. Closure of Pleasant Valley Dam in 1954 has almost eliminated the supply of gravel to the 16-mile study reach of the Owens River. Because of armoring of the channel, scour has been limited to approximately 1 foot in the upper 2.3 miles. Information in this report should be useful in determining long-term erosion effects below Pleasant Valley Dam, in assessing the feasibility of a proposed bypass channel versus retention of the main channel in its present state, and in determining man's influence on river morphology. Bank erosion is accelerated by wide ranges in flow release. Average annual bank-erosion rates were 750 tons from 1947 to 1967, 1,970 tons from 1967 to 1968, and 2,020 tons from 1968 to 1971. Hydraulic geometry at six sites indicates a shift in the river system regime since 1954. These changes have progressed downstream from the dam to a point between sites 4 and 5. Farther downstream channel changes will occur until the channel stabilizes. (Woodard-USGS) W76-06458

SOIL EROSION AND SEDIMENTATION IN TANZANIA AND LESOTHO, Secretariat for International Ecology, (Sweden). For primary bibliographic entry see Field 4D. W76-06593

INFLUENCE OF VESICULAR HORIZONS ON WATERSHED MANAGEMENT, Texas A and M Univ., College Station. Dept. of Range Science. For primary bibliographic entry see Field 4D. W76-06596

ANALYSIS AND INTERPRETATION OF LITORAL ENVIRONMENT OBSERVATION (LEO) AND PROFILE DATA ALONG THE WESTERN PANHANDLE COAST OF FLORIDA, Coastal Engineering Research Center, Fort Belvoir, Va. For primary bibliographic entry see Field 2L. W76-06637

SOIL STABILIZATION FOR EROSION CONTROL, Purdue Univ., Lafayette, Ind. School of Civil Engineering. For primary bibliographic entry see Field 4D. W76-06639

CONTROLLING RESERVOIR TRAP EFFICIENCY, Agricultural Research Service, Columbia, Mo. North Central Watershed Center. For primary bibliographic entry see Field 8B. W76-06682

THE BED-LOAD FUNCTION, Research Council of Alberta, Edmonton. Highway and River Engineering Div. S. Beltaos. Journal of the Hydraulics Division, Proceedings of American Society of Civil Engineers, Vol. 102, No. HY1, p 131-136, January 1976. 2 fig, 8 ref.

Descriptors: *Bed load, *Sediment transport, Sedimentation, Rivers, *River beds, *Sediment load, Sedimentation rates, Hydraulics, Turbulent flow, Stochastic processes. Identifiers: *Bed-load function, *Detached particles, Einstein bed-load function, Mean jump length.

A simple derivation of the bed-load function was presented. It was shown that the jump length of detached particles need not be assumed constant, and by treating it as a random variable, that it is only its mean value that influences the rate of transport regardless of what its probability density function may be. The present approach is considerably simpler than Einstein's in that it does not need to consider multiple jumps and their probabilities. Further, a simple empirical equation for the probability of detachment was developed, which could be helpful when dealing with applications of the bed-load function. (Lee-ISWS) W76-06683

THE TECHNIQUE OF REMOVING LARGE UNDISTURBED SAMPLES OF LAKE SEDIMENT: AN IMPROVED BORE PLUMB, (IN GERMAN), H. Ambuehl, and H. Buehrer. Schweiz z Hydrol 37(1), p 175-186, 1975.

Descriptors: *Lake sediments, *Sampling, Analytical techniques, Lakes.

A new sampling device for the extraction of completely undisturbed samples from the lake sediments is described. The core has a diameter of 110 mm and a length of 60 cm or more. Technical prerequisites include a sampling tube without interfering structure and with a very sharp end. The valve (to retain the sample) is designed so that water can flow out of the tube when the device is thrust into the sediment but is absolutely tight after sampling. If the sediment is compact (clay-like) sampling can be carried out without closing the tube at the base. There is an automatic closing mechanism for material with a high water content and an apparatus for subsequent preparation of the sample. W76-06776

2K. Chemical Processes

THERMODYNAMIC PROPERTIES OF BULK AND OCCCLUDED SUPER-COOLED WATER AND IONIC SOLUTIONS, Purdue Univ., Lafayette, Ind. Water Resources Research Center. For primary bibliographic entry see Field 1A. W76-06155

REGIONAL DISTRIBUTION OF THE MAJOR DISSOLVED SOLIDS IN THE STREAMS OF ILLINOIS, Northern Illinois Univ., De Kalb. Dept. of Geology. For primary bibliographic entry see Field 5B. W76-06163

Field 2—WATER CYCLE

Group 2K—Chemical Processes

HOT SPRINGS OF RHODESIA: THEIR NOBLE GASES, ISOTOPIC AND CHEMICAL COMPOSITION

University of the Witwatersrand, Johannesburg (South Africa). Nuclear Physics Research Unit. E. Mazor, and B. Th. Verhagen. Journal of Hydrology, Vol. 28, No. 1, p 29-43, January 1976. 6 fig, 3 tab, 11 ref.

Descriptors: *Hot springs, *Gases, *Thermal springs, *Chemical analysis, *Isotope studies, Analytical techniques, Mass spectrometry, Springs, Water types, Spring waters, Argon, Helium, Confined water, Hydrogen, Oxygen, Radioisotopes, Radio-chemical analysis, Chemistry, Instrumentation, Meteoric water, Hydrologic cycle, Ions.

Identifiers: *Noble gases, Isotopic composition, Chemical composition, *Rhodesia, Meteoric origin, Dissolved ions, Noble gas contents.

Four of Rhodesia's hottest spring complexes (54-100 C) were studied. Tritium contents were very low compared to adjacent rivers, indicating that the samples studied were indigenous, deep-seated water which had undergone negligible intermixing with surface water. The noble-gas measurements revealed: (1) the waters are meteoric; (2) the noble gases were kept in closed-system conditions in the ground; (3) paleotemperatures are 26-31 C; and (4) the boiling Binga springs lost part of their noble gases. Independently, measurements of stable isotopes indicated the meteoric origin of the springs. The chemical composition of the waters clearly reflected their origin from two groups of rocks - one from Karroo sediments and one from crystalline rocks. (Henley-ISWS) W76-06190

SUBARCTIC PLANT COMMUNITIES AND ASSOCIATED LITTER AND SOIL PROFILES IN THE CARIBOU CREEK RESEARCH WATERSHED, INTERIOR ALASKA

Cold Regions Research and Engineering Lab., Fairbanks, Alaska.

For primary bibliographic entry see Field 4D.

W76-06194

PUBLIC GROUNDWATER SUPPLIES IN PUTNAM COUNTY

Illinois State Water Survey, Urbana.

For primary bibliographic entry see Field 4B.

W76-06237

PUBLIC GROUNDWATER SUPPLIES IN MACOUPIN COUNTY

Illinois State Water Survey, Urbana.

For primary bibliographic entry see Field 4B.

W76-06257

CHEMICAL ANALYSIS AND ENVIRONMENTAL QUALITY

For primary bibliographic entry see Field 5A.

W76-06308

MEASUREMENT IN WATER RESEARCH: PART I

For primary bibliographic entry see Field 5A.

W76-06310

WATER QUALITY DATA ALBERTA 1961 - 1973

Department of the Environment, Ottawa (Ontario). Inland Waters Directorate; and Department of the Environment, Ottawa (Ontario). Water Quality Branch.

For primary bibliographic entry see Field 7C.

W76-06374

SODIUM, POTASSIUM, CALCIUM AND MAGNESIUM CONTENT OF NORTHWEST ARKANSAS RAIN WATER IN 1973

Arkansas Univ., Fayetteville. Dept. of Geology. For primary bibliographic entry see Field 2B.

W76-06379

SOLUTION CHEMISTRY, MASS TRANSFER, AND THE APPROACH TO CHEMICAL EQUILIBRIUM IN POROUS CARBONATE ROCKS AND SEDIMENTS

Illinois Univ., Urbana. Dept. of Geology. V. V. Palciauskas, and P. A. Domenico. Geological Society of America Bulletin, Vol. 87, No. 2, p 207-214, February 1976. 7 fig, 20 ref.

Descriptors: *Carbonate rocks, *Water chemistry, *Mass transfer, *Equilibrium, *Florida, Sedimentary rocks, Aqueous solutions, Dispersion, Convection, Chemical reactions, Saturation, Velocity, Groundwater movement, Geochemistry, Hydrogeology, Equations, Interfaces, Porous media, Kinetics, Temperature, Pressure, Calcite, Ion transport, Mathematical models.

Identifiers: *Floridan aquifer, Concentration gradients.

The physical and chemical processes that tend to promote an approach to equilibrium between an aqueous solution and one or more minerals in a carbonate system include dispersion, convection, and chemical reactions. When the spatial dependence of ionic constituents was examined from the point of view of these processes, the results showed that the distance to attainment of saturation with respect to an individual mineral increases with increasing rates of dispersion and velocity of groundwater and decreases with increasing rates of reaction. When all the concentration gradients approach zero, the resulting concentration was demonstrated to be a weighted average of the saturation concentrations for the individual minerals. The qualitative aspects of the predicted concentration behavior were in agreement with both field and experimental observations. (Visocky - ISWS) W76-06384

CHROMATOGRAPHIC DETERMINATION OF DMA AND DMF IN AQUEOUS MEDIUM

Vysoka Skola Chemicko-Technologiccka, Prague (Czechoslovakia). Dept. of Petroleum Technology and Petrochemistry.

For primary bibliographic entry see Field 5A.

W76-06390

SEMI-AUTOMATED AMMONIA PROBE DETERMINATION OF KJELDAHL NITROGEN IN FRESHWATERS

Ministry of Agriculture, Antrim (Northern Ireland). Freshwater Biological Investigation Unit.

For primary bibliographic entry see Field 5A.

W76-06391

THE LOWER WILCOX AQUIFER IN MISSISSIPPI

Geological Survey, Jackson, Miss.

For primary bibliographic entry see Field 7C.

W76-06444

SOUTHEASTERN MICHIGAN WATER-RESOURCES STUDY: GROUND WATER AND GEOLOGY

Geological Survey, Lansing, Mich.

For primary bibliographic entry see Field 4B.

W76-06457

PROGRESS REPORT ON THE WATER RESOURCES INVESTIGATION OF MARTIN COUNTY, FLORIDA

Geological Survey, Tallahassee, Fla.

For primary bibliographic entry see Field 4B.

W76-06459

ENVIRONMENTAL APPLICATIONS OF ADVANCED INSTRUMENTAL ANALYSIS: ASSISTANCE PROJECTS, FY 74

Southeast Environmental Research Lab., Athens, Ga.

For primary bibliographic entry see Field 5A.

W76-06647

ACTIVITY COEFFICIENTS OF BICARBONATES AND CARBONATES IN SEAWATER

Oregon State Univ., Corvallis. School of Oceanography.

For primary bibliographic entry see Field 5C.

W76-06720

THERMODYNAMIC LIMITATIONS ON THE USE OF THE PLATINUM ELECTRODE IN EH MEASUREMENTS

For primary bibliographic entry see Field 5A.

W76-06738

DETERMINATION OF PARTS PER BILLION SULFIDE IN WATER WITH THE SULFIDE-SELECTIVE ELECTRODE

Du Pont de Nemours (E. I.) and Co., Aiken, S. C. Savannah River Lab.

For primary bibliographic entry see Field 5A.

W76-06744

THE DETERMINATION OF CARBOHYDRATES IN NATURAL WATERS: A COMPARISON OF PAPER CHROMATOGRAPHIC, COLORIMETRIC AND ENZYMATIC METHODS, (IN GERMAN)

Freiburg Univ. (West Germany). Limnologisches Institut.

For primary bibliographic entry see Field 5A.

W76-06773

2L. Estuaries

BIOMASS OF ZOOPLANKTON IN THE NEWPORT RIVER ESTUARY AND THE INFLUENCE OF POSTLARVAL FISHES

National Marine Fisheries Service, Beaufort, N.C. Atlantic Coastal Fisheries Center.

G. W. Thayer, D. E. Hoss, M. A. Kjelson, A.

Hettler, and W. F. Lacroix, Jr. Chesapeake Sci. 15(1), p 9-16, 1974.

Descriptors: *Zooplankton, North Carolina, Estuaries, *Larvae, Biomass, Fishes, Plankton.

Identifiers: Brevoortia-Tyrannus, Lagodon-Rhomboides, Leiostomus-Xanthurus, *Newport River(North Carolina).

Numerical abundance biomass, and caloric content of zooplankton were estimated from biweekly samples collected during 1970-1972 from the lower estuary of the Newport River, North Carolina. All 3 measurements generally were maximum during early fall and again in late winter or early spring. During Nov., larval fishes, primarily pinfish (Lagodon rhomboides), spot (Leiostomus Xanthurus), and menhaden (Brevoortia tyrannus), began entering the estuary. The larvae reached maximum abundance in the estuary during March and April. Zooplankton abundance declined significantly at this time during 1970 and somewhat later during 1971. We hypothesize that zooplankton abundance may control the survival of fishes during their transition from larvae to juveniles and that the larvae have a significant effect in reducing the standing crop of zooplankton. Analysis of the gut contents of these fishes indicated they feed predominantly on zooplankton. Routine metabolism of the larvae would require that the standing crop of larvae graze an average 10% of the 1970 standing crop of zooplankton daily during Jan.-May. Copyright 1975, Biological Abstracts, Inc. W76-06153

ON A STOCHASTIC MODEL TO ESTIMATE TSUNAMI RISK,

Universidad Nacional Autonoma de Mexico, Mexico City. Facultad de Ingenieria. O. A. Rascon, and A. G. Villarreal. *Journal of Hydraulic Research*, Vol. 13, No. 4, p 383-403, 1975. 7 fig, 3 tab, 7 ref.

Descriptors: *Tsunamis, *Coasts, *Stochastic processes, *Statistical methods, *Model studies, *Mexico, *Hawaii, Waves(Water), Earthquakes, Hydrography, Analytical techniques, *Risks, Probability, Estimating. Identifiers: *Mexican Pacific coast, Bayes theorem.

In order to evaluate possibilities of exceedance of the maximum wave height during tsunamis along the Mexican Pacific coast, a statistical study was carried out on the tsunamis that have reached that coast. It was assumed that tsunamis follow a stochastic process represented by Poisson distribution which underlies earthquakes causing most of tsunamis. The available data was tested for consistency by split sampling. Since available data for the Mexican West Coast were scarce, data from other coasts having similar tectonic and hydrographic characteristics were incorporated by mean of Bayes theorem to obtain posterior probability densities. Estimation of the exceedance frequency for maximum amplitudes in the case of long recurrence periods was improved by a second order approximation method. The principal causes of wave height variations are the slope of the oceanic floor at the site, the existence of bays, reefs and promontories, the orientation of the wave front, and the distance to the place where the tsunami originates. (Singh-ISWS)

W76-06189

THE ECONOMIC VALUE OF REMOTE SENSING OF EARTH RESOURCES FROM SPACE: AN ERTS OVERVIEW AND THE VALUE OF CONTINUITY OF SERVICE. VOLUME IX. OCEANS.

Econ. Inc., Princeton, N. J.

For primary bibliographic entry see Field 7B. W76-06222

VIBRIO PARAHAEOLYTICUS IN SEA-WATER OFF THE PACIFIC COAST OF PANAMA,

Gorgas Memorial Lab., Balboa Heights, Canal Zone. M. Kourany, R. J. Kinney, and M. A. Vasquez. *Am J Trop Med Hyg*, 23(4 Part 1), p 714-715, 1974.

Descriptors: *Pathogenic bacteria, Bacteria, *Panama Canal, Pacific Ocean, *Canal zone, Sea water. Identifiers: Vibrio-Parahaemolyticus.

The presence of *V. parahaemolyticus* (pathogen causing diarrheal diseases) in Panama is reported. It was recovered from seawater off the Pacific coastline and in the channel of the Panama Canal. This is the 1st time this organism was isolated in Panama.—Copyright 1975, Biological Abstracts, Inc. W76-06252

SECONDARY SUCCESSION FOLLOWING EXTENDED INUNDATION OF TEXAS COASTAL RANGELAND,

Texas A. and M. Univ., College Station. Dept. of Range Science. For primary bibliographic entry see Field 4A. W76-06267

AN INVESTIGATION OF SUSPENDED MATERIAL CONCENTRATIONS IN EASTERN LONG ISLAND SOUND,

Connecticut Univ., Groton. Dept. of Geology; and Connecticut Univ., Groton. Marine Sciences Inst. W. F. Bohlen.

Journal of Geophysical Research, Vol. 80, No. 36, p 5089-5100, December 20, 1975. 12 fig, 30 ref. OWRT A-041-CONN (4) NOAA NG-20-72.

Descriptors: *Sediments, *Suspended solids, *Estuaries, Bays, Rivers, Erosion, On-site investigations, Sampling, Data processing, Analytical techniques, Sands, Silts, Salinity, Biological properties, Tides, *Connecticut River, Connecticut. Identifiers: *Long Island Sound(Conn).

A 2-year record of monthly observations of suspended material concentrations at a network of 11 stations in eastern Long Island Sound was used to detail the characteristics of the concentration field and the factors governing its variability. These suspended material distributions display a high degree of spatial and temporal variability, there being only weak correlation between concentrations and concurrent salinity. This behavior contrasts sharply with observations in other regions of the sound. To determine the relative importance of hydrodynamic, meteorological, and biological factors, an ensemble average of selected station data is introduced. This average displays a seasonal variability that can be represented by the combined effects of streamflow and wind stress. Streamflow serves to produce a persistent background concentration. The occurrence of higher frequency fluctuations due to aperiodic discharge events appears limited by the volume and mixing characteristics of the eastern sound. Wind events will dominate the concentration field if high stress levels are maintained for more than 48 hours. Duration requirements are most commonly satisfied during the winter months. Materials introduced by streamflows and wind stress are distributed by the high energy tidal stream. Biological factors exert minor influence on the variability of the concentration field. A review of this system suggested that the eastern sound is more properly viewed as a coastal embayment than as an estuary. Mixing in this area establishes the eastern boundary conditions for the remainder of the sound. (Sims - ISWS) W76-06381

EROSION ON THE LINE ISLANDS ARCHIPELAGIC APRON: EFFECT OF SMALL-SCALE TOPOGRAPHIC RELIEF,

Scripps Institution of Oceanography, San Diego. Marine Physical Lab. W. R. Normark, and F. N. Spiess. *Geological Society of America Bulletin*, Vol. 87, No. 2, p 286-296, February 1976. 11 fig, 2 tab, 42 ref. NSF GA-31377X.

Descriptors: *Marine geology, *Ocean circulation, *Sedimentation, *Erosion, *Bottom sediments, *Pacific Ocean, Glaciology, Instrumentation, On-site data collections, Tertiary period, Bathymetry. Identifiers: Deep-towed instrumentation, Sea moats, Line Islands, Submarine peaks.

A moat on the southern edge and another in the northern portion of a small area on the northeast flank of the Line Islands archipelagic apron were studied, using a deep-towed geophysical instrumentation system. These studies showed that flow of bottom currents around relatively small bathymetric features (less than 200 m high) on the Line Islands apron has resulted in substantially more erosion than has occurred adjacent to a nearby ridge 1500 m high. Erosion has produced coalescing moats on the upcurrent sides of two basement outcrops that are the vestiges of a seamount nearly buried by sedimentary deposits of the apron. Pacific Bottom Water, moving eastward through nearby Kingman Passage, is thought to have eroded the moats during glacial periods. Episodic increases of eastward flow of Bottom Water may be occurring at present with velocities sufficient to form ripples within the sandy sediments of the moat floor. Within the same area, a large submarine ridge is flanked by a shallow moat that is merely the result of lower rates of deposi-

tion than on the surrounding sedimentary apron. (Singh-ISWS) W76-06386

A COMPARISON OF THE RESPONSES OF IDENTICAL CUP ANEMOMETERS MOUNTED ON A SPAR AND A TOROID BUOY,

Oregon State Univ., Corvallis. School of Oceanography. For primary bibliographic entry see Field 7B. W76-06392

THE SALINITY EFFECT IN A MIXED LAYER OCEAN MODEL,

National Aeronautics and Space Administration, New York. Goddard Inst. for Space Studies. J. R. Miller. *Journal of Physical Oceanography*, Vol. 6, No. 1, p 29-35, January 1976. 4 fig, 2 tab, 9 ref.

Descriptors: *Salinity, *Ocean circulation, *Stratification, *Heat transfer, *Mixing, *Atlantic Ocean, Model studies, Temperature, Oceans, Saline water, Sea water, Thermal stratification, Movement, Diffusion, Circulation, Convection, Tropic, Subtropic, Path of pollutants. Identifiers: *Mixed layer, Deepening rates.

A model of the thermally mixed layer in the upper ocean as developed by Kraus and Turner and extended by Denman was further extended to investigate the effects of salinity. In the tropical and subtropical Atlantic Ocean rapid increases in salinity occur at the bottom of a uniformly mixed surface layer. The most significant effects produced by the inclusion of salinity are the reduction of the deepening rate and the corresponding change in the heating characteristics of the mixed layer. If the net surface heating is positive, but small, salinity effects must be included to determine whether the mixed layer temperature will increase or decrease. Precipitation over tropical oceans leads to the development of a shallow stable layer accompanied by a decrease in the temperature and salinity at the sea surface. (Bender-ISWS) W76-06393

TEMPERATURE AND SALINITY STRUCTURE IN THE WEDDELL SEA,

Scripps Institution of Oceanography, La Jolla, Calif. T. D. Foster, and E. C. Carmack. *Journal of Physical Oceanography*, Vol. 6, No. 1, p 36-44, January 1976. 5 fig, 29 ref. NSF GV-34905.

Descriptors: *Antarctic, *Water circulation, *Temperature, *Salinity, *Convection, *Antarctic Ocean, Circulation, Ocean circulation, Saline water, Sea water, Upwelling, Mixing, Movement, Diffusion. Identifiers: *Weddell Sea, Ekman flux, Double-diffusive convection, Cabelling instability, Scotia Ridge, Cape Norvegia.

The general circulation of water in the Weddell Sea is part of a large cyclonic gyre. A section taken across this gyre from the Scotia Ridge to Cape Norvegia showed that the Warm Deep Water forms an asymmetric lens-like structure with the thickest portion south of the center of the sea. This large-scale feature of the Weddell Sea is evidently due to a divergent Ekman flux driven by the general atmospheric circulation and upwelling in the center of the gyre. Vertical profiles of temperature and salinity in the center of the gyre showed small step-like structures in the upper part of the transition from colder, less salty Winter Water to the warmer, saltier Warm Deep Water below and large step-like structures in the lower part of the transition region. Double-diffusive convection can take place in both regions. Circumstantial evidence indicated that the cabelling instability is effective in the large-step region. Internal waves and shear instabilities may also be

Field 2—WATER CYCLE

Group 2L—Estuaries

mechanisms that contribute to the formation of the step-like structures. (Bender-ISWS)
W76-06394

WAVE FORCES ON BOTTOM-MOUNTED LARGE-DIAMETER CYLINDER.
Naval Postgraduate School, Monterey, Calif.
Dept. of Mechanical Engineering.
For primary bibliographic entry see Field 8B.
W76-06395

TIDE-INDUCED MASS TRANSPORT IN LAGOONS.
Miami Univ., Fla. Div. of Ocean Engineering; and Rosenstiel School of Marine and Atmospheric Science.
J. van de Kreeke, and R. G. Dean.
Journal of the Waterways, Harbors and Coastal Engineering Division, American Society of Civil Engineers, Vol. 101, No. WW4, Proceedings Paper 11731, p 393-403, November 1975. 7 fig, 12 ref, 2 append. NSF GK-32654

Descriptors: *Lagoons, *Mass transfer, *Mixing, *Water circulation, Bays, Inlets(Waterways), Density currents, Convection, Diffusion, Mathematical studies, Analytical technique, Coastal engineering, Estuaries, Tides.
Identifiers: *Mass transport, *Gulf coast, *Atlantic coast, Flushing.

Tide-induced mass transport is examined in coastal lagoons which are connected to the ocean by more than one opening. An approximate analytic expression for the tide-induced mass transport in a lagoon of uniform width and depth at each end freely connected to a tidal basin was derived, assuming one-dimensional homogeneous flow. Analytic results were compared with numerically computed values of the mass transport. It was shown that the tide-induced mass transport can be an important factor in the renewal of the waters of shallow lagoons. However, since tide-induced mass transport is proportional to the ratio a/h to the second power, where a = amplitude of the tidal wave and h = depth with respect to still water level significant mass transport should be expected only in shallow lagoons. (Bender-ISWS)
W76-06396

STATISTICS OF RANDOM WAVE FIELD.
Worley Engineering Inc., Houston, Tex.
For primary bibliographic entry see Field 8B.
W76-06397

LARGE WAVE TANK TESTS OF RIPRAP STABILITY.
Coastal Engineering Research Center, Fort Belvoir, Va.
For primary bibliographic entry see Field 8B.
W76-06410

CLASSIFICATION OF WETLANDS VEGETATION USING SMALL SCALE COLOR INFRARED IMAGERY.
Smithsonian Institution, Edgewater, Md. Chesapeake Bay Center for Environmental Studies.
F. S. L. Williamson, B. L. Rice, and D. F. Cassel.
Available from the National Technical Information Service, Springfield, Va 22161 as N75-17768, \$4.00 in paper copy, \$2.25 in microfiche. Annual Report, October 9, 1973 to December 20, 1974, NASA CR-62091, February 1975. 26 p, 8 fig, 16 ref. NASA NAS6-1913.

Descriptors: *Remote sensing, *Wetlands, *Vegetation, *Chesapeake Bay, Aerial photography, Infrared radiation, Photography, *Classification, Marshes, Plant groupings, Data processing, Marsh management.

The purpose of the research reported was to consider classification systems for Chesapeake Bay

wetland vegetation. Data processing programs were tested for remotely sensed data on color infrared aerial photos from a small wetlands area and performed detailed vegetation ordinations on field data from another marsh site. Small scale (1:130,000) imagery can, after being digitized and computer processed, distinguish between species associations of *Spartina patens*/*Distichlis spicata*, *Juncus roemerianus*, *Spartina alterniflora*, and mixtures which are predominantly *Scirpus olneyi*. Estimates made from the computer-produced map of the areas covered by each association are only approximate and may err by as much as 50%. Two consecutive frames of a marsh scene were classified individually. The class designations for vegetation types were the same for both frames, with the exception of the reversal of one of the water classes with one of the *Spartina patens* classes. The spectral values (spectral signatures) for classes were not the same for both frames, suggesting that standardization of signatures for native plant associations will be difficult. (Sims-ISWS)
W76-06411

ADVANCES IN HYDROSCIENCE, VOLUME 10-1975.
For primary bibliographic entry see Field 8B.
W76-06412

TIDAL THEORY AND COMPUTATIONS.
Hydraulic Dept. of Deltaworks, The Hague (Netherlands).
J. J. Dronkers.
In: Advances in Hydroscience, Volume 10-1975. Academic Press, New York, New York, p 145-230, 1975. 16 fig, 83 ref.

Descriptors: *Tides, *Tidal waters, *Theoretical analysis, *Oceans, Sea level, Water levels, Water circulation, Tidal streams, Water level fluctuations, Open channel flow, Mathematical studies, Finite element analysis, Analytical techniques, Continuity equation, Equations, Forecasting, Waves(Water), Harbors, Rivers, Junctions, Coasts, Estuaries.
Identifiers: *Tidal equations, Equations of motion.

Development of tidal theory since 1964 was presented in three broad subject areas. (1) Analysis of tides dealt with the basic equations for the prediction of tides. The tidal potential was presented with two methods for tidal prediction: the harmonic method and the response method. A practical application of the harmonic method also was given. (2) Tidal equations discussed the hydrodynamic tidal equations for the dynamic behavior of the tides, for which emphasis was given to the vertical velocity distribution in the derivation of the equations. The convective terms in the dynamic equations were studied separately by introducing terms containing the energy head and the rotor of the velocity vector. The relation between the rotor and the circulation of the water movement was also mentioned. (3) Tidal computations dealt with tidal computations in rivers, seas, and coastal waters. A brief historical review of various methods of computation was given. The harmonic method and the characteristic method were discussed in general terms. The theory of the Kelvin wave for seas with parallel coastal lines was given in more detail because of its theoretical interest for the explanation of the amphidromic points. The main part of this section was devoted to the finite-difference methods to be applied on an electronic computer. More detailed examples of explicit and implicit schemes were given for one- and two-dimensional tidal regions, and practical results were presented. (See also W76-06412) (Humphreys-ISWS)
W76-06414

A STUDY TO ASSESS GOALS FOR USES AND MANAGEMENT OF SHORELINE AND IMPLI-

CATIONS FOR CORPS OF ENGINEERS PROGRAMS.
Coastal Zone Resources Corp. Wilmington, N. C.
For primary bibliographic entry see Field 6B.
W76-06418

NUTRIENT TRANSFORMATIONS IN MASS CULTURES OF MARINE ALGAE.
Woods Hole Oceanographic Institution, Mass.
Dept. of Biology.
For primary bibliographic entry see Field 5C.
W76-06441

DECISIONS FOR DELAWARE: SEA GRANT LOOKS AT LEGAL ASPECTS OF OCS DEVELOPMENT.
Delaware Univ., Newark. Center for the Study of Marine Policy.
For primary bibliographic entry see Field 6E.
W76-06485

JAPAN AND THE UNITED NATIONS CON- FERENCE ON THE LAW OF THE SEA.
Johns Hopkins Univ., Washington, D.C., School for International Studies.
For primary bibliographic entry see Field 6E.
W76-06491

INVENTORY OF FLORIDA COASTAL ZONE PLANNING PUBLICATIONS: VOLUME I, COASTAL COUNTIES AND CITIES.
Florida Dept. of Natural Resources, Tallahassee.
Bureau of Coastal Zone Planning.
September 1975, 103 p.

Descriptors: Publications, *Bibliographies, *Florida, *Coasts, Documentation, Coastal engineering, Coastal marshes, Coastal plains, *Cities, *Planning, *Surveys.
Identifiers: *Florida coastal zone, Florida publications, Florida bibliographies, Florida coastal counties, Florida coastal cities.

Volume I inventories those planning documents which have application to one of the 38 coastal counties or to any of the cities lying within the designated coastal zone of the county. (See also W76-06567 and W76-06568)(NDAA)
W76-06566

INVENTORY OF FLORIDA COASTAL ZONE PLANNING PUBLICATIONS: VOLUME II, MULTI-COUNTY PLANNING DISTRICTS.
Florida Dept. of Natural Resources, Tallahassee.
Bureau of Coastal Zone Planning.
September 1975, 32 p. 04-4-158-50018, PL 92-583.

Descriptors: Publications, *Bibliographies, *Florida, *Coasts, Documentation, Coastal engineering, Coastal marshes, Coastal plains, *Surveys, Planning.
Identifiers: *Florida coastal zone, Florida publications, Florida bibliographies, *Planning districts.

Volume II includes those planning publications with a regional perspective. Documents in this volume address either the respective planning district as a whole, or areas encompassing more than one county within the district. (See also W76-06566 and W76-06568)(NOAA)
W76-06567

INVENTORY OF FLORIDA COASTAL ZONE PLANNING PUBLICATIONS: VOLUME III, STATEWIDE.
Florida Dept. of Natural Resources, Tallahassee.
Bureau of Coastal Zone Planning.
September 1975, 22 p. 04-4-158-50018, PL-92-583.

Descriptors: Publications, *Bibliographies, *Florida, *Coasts, Documentation, Coastal engineering, Coastal marshes, Coastal plains, *Surveys, Planning.

Identifiers: *Florida coastal zone, Florida publications, Florida bibliographies, *Planning districts.

Volume III inventories those relevant documents that focus on either the state of Florida as a whole, or on areas that overlap planning district boundaries. (See also W76-06566 and W76-06567) (NOAA)
W76-06568

**THE GREEN BAY WATERSHED
PAST/PRESENT/FUTURE,**
Wisconsin Univ., Madison Inst. for Environmental Studies.
For primary bibliographic entry see Field 5C.
W76-06569

KANEOCHE ALTERNATIVES: AN APPLICATION OF IMPACT METHODOLOGY.
Hawaii Environmental Simulation Lab., Honolulu.
For primary bibliographic entry see Field 6G.
W76-06574

STATE-OF-THE-ART SURVEY AND EVALUATION OF MARSH PLANT ESTABLISHMENT TECHNIQUES: INDUCED AND NATURAL; VOLUME I: REPORT OF RESEARCH,
Michigan Univ., Ann Arbor, School of Natural Resources.
For primary bibliographic entry see Field 4A.
W76-06635

STATE-OF-THE-ART SURVEY AND EVALUATION OF MARSH PLANT ESTABLISHMENT TECHNIQUES: INDUCED AND NATURAL; VOLUME II: A SELECTED ANNOTATED BIBLIOGRAPHY ON AQUATIC AND MARSH PLANTS AND THEIR MANAGEMENT,
Michigan Univ., Ann Arbor, School of Natural Resources.
For primary bibliographic entry see Field 4A.
W76-06636

ANALYSIS AND INTERPRETATION OF LITTORAL ENVIRONMENT OBSERVATION (LEO) AND PROFILE DATA ALONG THE WESTERN PANHANDLE COAST OF FLORIDA,
Coastal Engineering Research Center, Fort Belvoir, Va.
J. H. Baisillie.

Available from the National Technical Information Service, Springfield, Va. 22161 as AD/A-009 755 \$5.50, in paper copy, 2.25 in microfiche. Technical Memorandum No. 49, March 1975. 104 p, 33 fig, 12 tab, 63 ref. 5 append.

Descriptors: *Coasts, *Geomorphology, *Littoral drift, *Florida, Sediments, Sedimentation, Sands, Sediment transport, Beaches, Beach erosion, Winds, Storms, On-site investigations, Aerial photography, Remote sensing, Waves(Water), Ocean waves, Currents(Water).

In 1969, observation and profile stations were established along a 100-mile segment of the western panhandle coast of Florida. Visual measurements of littoral phenomena were taken using systematic techniques of the Littoral Environment Observation (LEO) Program. At six LEO stations, daily observations were made of breaker height, period, and direction of approach, longshore current speed and direction, and windspeed and direction. Foreshore slope was measured daily, and sand samples were collected monthly. Monthly profiles were measured from piers at six localities. Breaker heights were found to increase from east to west. Waves approached the shoreline from eastern quadrants a greater percent of the time than from western quadrants especially along the western part of the study area, showing agreement with net westerly directed longshore current and longshore transport movement, and dominant wind approach directions. Net annual

longshore currents ranged from 0.50 to 0.30 ft/s, and were higher in magnitude along the western part of the study area than along the eastern segment. Predicted net annual longshore transport rates ranged from 196,000 to 274,000 cubic yards per year, and again were larger to the west than to the east. Volume change between consecutive monthly profiles indicated net losses of sediment from the littoral zone along most of the study area, with only serious losses at one locality along the western segment. Profile data and aerial photos showed the coast to be characterized by a dual bar system—an inner bar that at times is linear and at other times is broken and sinuous; and an outer, more continuous, persistent bar that acts as a buffer to storm wave attack. (Sims-ISWS)
W76-06637

AN ASSESSMENT OF THE EXPECTED IMPACT OF A DREDGING PROJECT PROPOSED FOR PALA LAGOON, AMERICAN SAMOA,
Hawaii Univ., Honolulu. Sea Grant Program.
For primary bibliographic entry see Field 6G.
W76-06654

USE OF SILVER AND ZINC TO TRACE SEWAGE SLUDGE DISPERSAL IN COASTAL WATERS,
Delaware Univ., Newark. Coll. of Marine Studies.
For primary bibliographic entry see Field 5B.
W76-06655

OBSERVATIONS OF CURRENTS AND TEMPERATURES IN THE SOUTHEAST FLORIDA COASTAL ZONE DURING 1971-72,
National Oceanic and Atmospheric Administration, Boulder, Colo. Environmental Research Labs.
D. A. Mayer, and D. V. Hansen.
For sale by the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402. NOAA Tech. rpt. ERL 346-AOML 21, June 1975. 36 p, 11 fig, 3 tab, 3 ref.

Descriptors: Oceans, *Oceanography, *Ocean currents, *Temperature, Tides, Tidal currents, Ocean tides, Velocity measurement, Water flow, Temperature measurement, *Florida, *Coasts. Identifiers: *Tidal motions, *Current measurement, Coastal water, Coastal zone, Southeast Florida.

Southeast Florida's coastal processes, including currents, temperatures, and wind movements, are described. Fluxes of heat and momentum computed using temperature and velocity measurements as observed in the coastal waters are described. The data recorded indicated that the long, narrow, and shallow shelf region of Southeast Florida is distinctly different from the deeper offshore water where the dominant motions are those of the Florida Current. The shallow water is primarily wind driven, but also subject to tidal motions near tidal inlets. In long current measurement records, the net northward motion is nearly zero. In the winter, the temperature of coastal water is less than the temperature of offshore water by about 1/2 degrees C/km. This positive east-west gradient of temperature is caused by the frequently occurring cold fronts which pass regularly over South Florida in the winter. The momentum flux that had the most spatial variation and, hence, whose divergence was also the largest, was the low frequency covariance between the north and east components of current where its sign actually changed from -26 to 20 cm²/sec² over a distance of only 2 km. (NOAA).
W76-06656

FORTAN GRAPHICS PROGRAMS FOR PHYSICAL OCEANOGRAPHIC AND TIME SERIES DATA,
Rhode Island Univ., Kingston. Graduate School of Oceanography.
For primary bibliographic entry see Field 7C.

W76-06661

SEWAGE SLUDGE AND AMMONIUM CONCENTRATIONS IN THE NEW YORK BIGHT APEX,
State Univ. of New York at Stony Brook. Marine Sciences Research Center.
For primary bibliographic entry see Field 5B.
W76-06667

PENETRATION OF THE DEEP LAYER OF THE SAGUENAY FJORD BY SURFACE WATERS OF THE ST. LAWRENCE ESTUARY,
Laval Univ., Quebec. Departement de Biologie.
J. C. Theriault, and G. Lacroix.
Journal of the Fisheries Research Board of Canada, Vol. 32, No. 12, p 2373-2377, December 1975. 5 fig, 9 ref.

Descriptors: *Fjords, *Penetration, *Surface waters, *Canada, *St. Lawrence River, *Chemical properties, *Physical properties, Biological properties, Physicochemical properties, Analytical techniques, Chemical analysis, Oceans, Chlorophyll, Plant pigments, Salinity, Water quality, Water temperature, Phosphates, Nitrates, Dissolved oxygen, Destratification, Seasonal, Nutrients.
Identifiers: Saguenay Fjord, St. Lawrence estuary, Surface water penetration, Flood tides, Advection waters.

A strong similarity is demonstrated in summertime physicochemical characteristics between the deep water of the Saguenay fjord and the surface water of the St. Lawrence estuary. Summer warming of the deep layer of the Saguenay is progressive from the mouth towards the head of the fjord. The mechanism proposed was the penetration of surface estuarine water over the shallow sill during the rising tide. The abnormally high chlorophyll values in this deep layer may be explained by the same advective mechanism. (Henley - ISWS)
W76-06674

UPWELLING ALONG THE YARMOUTH SHORE OF NOVA SCOTIA,
Dalhousie Univ., Halifax (Nova Scotia). Dept. of Oceanography.
C. J. R. Garrett, and R. H. Loucks.
Journal of the Fisheries Research Board, Vol. 33, No. 1, p 116-117, January 1976. 1 fig, 6 ref.

Descriptors: *Upwelling, *Coasts, *Ocean circulation, *Canada, Circulation, Tides, Tidal effects, Tidal energy, Coriolis force, Currents(Water), Estuaries, Oceanography.
Identifiers: *Nova Scotia, Centrifugal force.

Coastal upwelling seems to occur off the southwestern shore of Nova Scotia. It was suggested that this may be driven by centrifugal forces associated with the strong tidal currents past the convex coastline, in much the same way as secondary circulation is generated for river flow round a bend. (Sims-ISWS)
W76-06688

A SIMPLE TOPOGRAPHIC MODEL OF GULF STREAM SEPARATION,
Monash Univ., Clayton (Australia). Dept. of Mathematics.
N. R. Smith, and C. B. Fandry.
Journal of Physical Oceanography, Vol. 6, No. 1, p 22-28, January 1976. 10 fig, 28 ref.

Descriptors: *Model studies, *Ocean circulation, *Atlantic Ocean, *Mathematical models, Circulation, Currents(Water), Winds, Topography, Boundary layers, Oceanography.
Identifiers: *Gulf Stream.

A simple, frictional, linear model was used to study the motion of the Gulf Stream over the con-

Field 2—WATER CYCLE

Group 2L—Estuaries

tinental shelf. It was found that the combination of frictional and topographic effects may provide a further mechanism by which the observed separation of the Gulf Stream may be achieved. The model predicted separation in the form of a classical separated boundary layer and interrelated the slope of the bottom with the position of separation. Counter-circulations northwest of the stream and increased northward transport of the current were also predicted. (Sims-ISWS)
W76-06689

VERTICAL STRUCTURE OF CURRENTS AND DEEP TEMPERATURES IN THE WESTERN SARGASSO SEA,
Lamont-Doherty Geological Observatory,
Palisades, N.Y.
T. E. Pochapsky.
Journal of Physical Oceanography, Vol. 6, No. 1, p 45-56, January 1976. 11 fig, 2 tab, 12 ref. ONR N0014-67-A-0108-0011, NSF GX 30987.

Descriptors: *Ocean circulation, *Ocean currents, *Temperature, *Atlantic Ocean, Currents(Water), Velocity, Sampling, Measurement, On-site investigations, On-site data collections, Buys, Floats, Oceanography.
Identifiers: *Sargasso Sea, Temperature profiles, Velocity profiles.

Currents and temperatures were measured as a function of depth at two locations during the Mid-Ocean Dynamics Experiments of 1972-73. Instrumented profiling floats were used and flows were determined by acoustic ranging. In some instances floats were trimmed to hover at definite depths in order to increase the resolution and measure local details. The barotropic flows were large, 4.6 cm/s at the 28 deg N, 69 deg 40 min W location and 7.8 cm/s at the 28 deg N, 68 deg 40 min W location. The energy density of the first baroclinic mode was larger than that of the barotropic flow at both locations. The shapes of the horizontal trajectories of the profiling floats changed only slowly from day to day. Superimposed on these profiles were velocity variations of the high vertical wavenumber modes associated with inertia and internal waves. They were within a band of + or -1.5 cm/s below the thermocline and + or -3.5 cm/s in the thermocline. Current profiles as well as hodographs of the velocity on descent showed a chaotic modal structure for those higher frequencies. There was a suggestion of a relationship between the velocity fluctuations profiled and profiles of the temperature or temperature gradient only in a high-resolution section of data near a depth of 2 km. The occurrence of Richardson numbers near unity was fairly common over depth intervals of approximately 100 m. (Sims-ISWS)
W76-06690

STUDY OF THE DISPERSION OF BACTERIOPHAGES IN A NATURAL MARINE ENVIRONMENT, (IN FRENCH),
Centre d'Etudes et de Recherches de Biologie et d'Océanographie Médicale, Nice (France); and Institut National de la Recherche Médicale, Paris (France).
For primary bibliographic entry see Field 5B.
W76-06691

THE DYNAMIC STRUCTURE OF THE FRONTAL ZONE IN THE COASTAL UPWELLING REGION OFF OREGON,
Rosenstiel School of Marine and Atmospheric Science, Miami, Fla.
C. N. K. Mooers, C. A. Collins, and R. L. Smith.
Journal of Physical Oceanography, Vol. 6, No. 1, p3-21, January 1976. 16 fig, 5 tab, 64 ref. NSF GP4472, GA331, GA27296.

Descriptors: *Upwelling, *Coasts, *Oregon, *Pacific Ocean, Ocean currents, Currents(Water), On-site data collections, On-site investigations, Temperature, Salinity, Continental shelf, Continental slope, Oceans, Oceanography.

Identifiers: Pycnoclines.

The frontal zone of the coastal upwelling region off Oregon was studied from observations made between July and September in 1965 and 1966. The alongshore flow field was determined by combining direct measurements and geostrophic calculations. A near-surface southward jet and a subsurface northward undercurrent existed in the frontal zone. They were separated by an inclined frontal layer (permanent pycnocline). The frontal layer tended to intersect the sea surface about 10 km offshore, where a surface front was formed. Through a combination of direct current measurement and water mass analysis, the cross-stream flow was estimated to be seaward near the surface, shoreward at the top of the inclined frontal layer, but seaward at the bottom of the inclined frontal layer and shoreward below that. During a 25 h anchor station, a high degree of correlation existed between the vertical structure of the alongshore and cross-stream flows. An anomalously warm water mass occurred at the base of the frontal layer. It is believed that it was formed near the surface front and that it sank and flowed seaward along the base of the inclined frontal layer. Vertical shears in the horizontal velocity were caused by the mean baroclinic flow and the tidal and longer period baroclinic oscillations. (Sims - ISWS)
W76-06695

TELEDETECTION BY AIRPLANE AND SATELLITE IN THE STUDY OF MARINE POLLUTION, (IN FRENCH),
Centre d'Etudes et de Recherches de Biologie et d'Océanographie Médicale, Nice (France).
For primary bibliographic entry see Field 5A.
W76-06717

DEGREE OF POLLUTION OF THE SAINT LAWRENCE RIVER FROM REPENTIGNY TO MONTMAGNY, (IN FRENCH),
Laval Univ., Quebec. Departement des Vivres.
For primary bibliographic entry see Field 5B.
W76-06734

DEGREE OF POLLUTION OF THE SAINT LAWRENCE RIVER FROM REPENTIGNY TO MONTMAGNY: II. BIOCHEMICAL POLLUTION, (IN FRENCH),
Laval Univ., Quebec. Departement Des Vivres.
For primary bibliographic entry see Field 5B.
W76-06735

THERMODYNAMIC LIMITATIONS ON THE USE OF THE PLATINUM ELECTRODE IN EH MEASUREMENTS,
For primary bibliographic entry see Field 5A.
W76-06738

THE WINTER DISTRIBUTION OF ULTRAVIOLET ABSORPTION IN THE SURFACE WATERS OFF THE WEST COAST OF THE BRITISH ISLES,
University Coll. of North Wales, Menai Bridge. Marine Science Labs.
For primary bibliographic entry see Field 5B.
W76-06739

SEASONAL DISTRIBUTION OF ULTRAVIOLET ABSORPTION IN THE SURFACE WATERS OF LIVERPOOL BAY,
University Coll. of North Wales, Menai Bridge. Marine Science Labs.
For primary bibliographic entry see Field 5B.
W76-06740

THE IMPORTANCE OF THE EFFECT OF THE CHEMICAL COMPOSITION OF WATER ON THE POPULATION OF SNAILS: INTER-

MEDIATE HOSTS OF SCHISTOSOMES IN EGYPT,
Bilharziasis Research Inst., Cairo (Egypt).
For primary bibliographic entry see Field 5C.
W76-06763

PHYTOSOCIOLOGICAL STUDIES OF AQUATIC AND MARSH VEGETATION IN MORE OG ROMSDAL, WESTERN NORWAY, (IN NORWEGIAN),
L. Malme.
K Nor Vidensk Selsk Mus Misc 22, p 1-30, 1975.

Descriptors: Lakes, Europe, Vegetation, *Marsh plants, Marshes, Aquatic life, Ecology.
Identifiers: *Hydrochemical studies, *Norway, Phytosociological studies.

Phytosociological descriptions are given of aquatic and marsh communities in 26 lowland lakes. Eleven vegetational types are distinguished on a basis of floristic composition, belonging to the 3 classes: Potametea, Littorelletea and Phragmitetea. Ecological conditions are discussed. The different associations have wide tolerance limits with regard to certain hydrochemical factors.-Copyright 1975, Biological Abstracts, Inc.
W76-06767

SEQUENCES OF EFFECTS OF A CITY SEWER: AS A FUNCTION OF THE REMOVAL OF THE SOURCE OF POLLUTION, ON THE PHOTO-PHILE POPULATIONS GROWING IN EXPOSED PLACES (ALGAL FRACTION); FIRST RESULTS, (IN FRENCH),
Aix-Marseille-2 Univ. (France). Laboratoire de Biologie Vegetale.
For primary bibliographic entry see Field 5C.
W76-06770

THE HEAVY METAL CONCENTRATIONS IN THE MARINE SEDIMENTS ALONG THE COAST OF FUKUYAMA, (IN JAPANESE),
Kagoshima Univ. (Japan). Marine Biology Lab.; and Kagoshima Univ. (Japan). Environmental Sciences.
For primary bibliographic entry see Field 5A.
W76-06774

SUSPENDED MATTER AND ITS COMPONENTS IN THE BLACK SEA, (IN RUSSIAN),
Institute of Biology of the Southern Seas, Sevastopol (USSR).
For primary bibliographic entry see Field 5B.
W76-06778

PETROLEUM-OXIDIZING BACTERIA FROM THE GULF OF FINLAND, (IN RUSSIAN),
Dep. Moscow State Univ. (USSR). Dept. of Microbiology.
For primary bibliographic entry see Field 5C.
W76-06788

3. WATER SUPPLY AUGMENTATION AND CONSERVATION

3A. Saline Water Conversion

THE RALPH M. PARSONS COMPANY CONCEPTUAL DESIGN OF A 50 MGD DESALINATION PLANT.
Parsons (Ralph M.) Co., Pasadena, Calif.
Available from the National Technical Information Service, Springfield, Va 22161, as PB-251 584, \$9.00 in paper copy, \$2.25 in microfiche. Special Report No. 12, August 1965, 492 p, 24 fig, 9 tab. OSW 14-01-0001-516.

Saline Water Conversion—Group 3A

Descriptors: *Desalination, Distillation, *Flash distillation, Sea water, *Heat transfer, Design, Instrumentation, *Evaporation, *Condensation, Economics, Evaluation, Costs, *Design criteria.
Identifiers: *Process design.

The objective of this study is to produce a design which advances the technology of seawater conversion and to present the results in a form which can be used by any qualified individual or firm as the basis for an architectural-engineering design. Ground rules furnished by OSW specified that only the desalination section of a dual-purpose power-water plant be considered and that it be designed for a 30-year life. Process and structural design ideas are to be presented in terms of the complete plant concept. The complex is to be located on a typical California coastal site with capital and operating costs based on December, 1964, values. This design concept is based on the multistage flash process consisting of 94 heat recovery stages and 4 heat rejection stages with a maximum brine temperature of 273°F. Plant consists of three parallel lines each supplying one-third the total output, each operating independently of the others to facilitate maintenance and repairs. Vessels are of corrugated metal pipe arch section permitting longitudinal thermal expansion to be absorbed within the vessel walls. Interior surfaces of the vessels exposed to seawater are cupro-nickel clad. 70-30 CuNi is selected for heat exchange surfaces. Cost of product water is \$0.525 per thousand gallons. (See also W76-00158 thru W76-00173.) (OWRT)

DESALTING PLANTS INVENTORY, REPORT NO. 4.

Office of Saline Water, Washington, D.C.
F. O'Shaughnessy.
Available from the National Technical Information Service, Springfield, Va 22161, as PB-251-575, \$4.00 in paper copy, \$2.25 in microfiche. March, 1973, 27 p, 1 fig, 4 tab.

Descriptors: *Desalination plants, Surveys, *Distillation, Water supply, *Membrane process, *Freezing, Sites, Dual purpose, Fuels, Electric power plants.

Summary information is provided on location, size, type of process, year construction began or of plant commissioning, and name of process contractor. Also included, when and as provided by the manufacturer, are data on type of water feed, product water use, type of fuel used, and whether or not a desalting plant operates in conjunction with an electric power generating plant (single or dual purpose). According to manufacturer's information, there were 812 land-based desalting plants of 25,000 gallons-per-day capacity or larger in operation or under construction throughout the world as of January 1, 1972. These plants are capable of producing about 348 million gallons of fresh water daily for cities and industries. Distillation is the most widely used, accounting for 93% of total capacity. The balance is almost entirely in membrane processes, with freezing accounting for less than 1%.

DISPOSAL OF SOLUBLE INORGANIC SALTS,
Tulsa Univ., Okla.
For primary bibliographic entry see Field 5D.
W76-06156

CONVERSION OF DESALINATION PLANT BRINES TO SOLIDS,
Badger (W. L.) Associates, Inc., Ann Arbor, Mich.
F. C. Standiford.
OWRT/S--76/29, October 10, 1970. 118 p, 29 fig, 19 tab, 27 ref. DoI 14-30-2660.

Descriptors: *Dissolved solids, Desalination plants, Brines, *Brine disposal, *Desalination,

Distillation, Solar evaporation, Pounding, Cost comparisons, Injection wells, Waste disposal, Solid wastes, Feasibility.
Identifiers: Deepwell injection.

This final report of a study to investigate means of turning desalination plant waste brines into solids for disposal surveys the chemical and process industries to determine those processes which have a potential for removing or reducing solids from solution when treating the brine effluent from desalination plants. It attempts to determine the potential size limitations of various methods and by comparing advantages and disadvantages to determine the economic feasibility of each. A conceptual design is presented for a plant treating the effluent from a 2.5 MGD desalination plant to evaluate the feasibility of such a system and provide plant scaling factors for 1 to 10 MGD plants. Capital and operating cost estimates are provided.

PARAMETRIC DATA FOR LONG TERM OPERATION OF A VERTICAL, PLANE SURFACE, FALLING FILM, VAPOR COMPRESSION EVAPORATOR,

Resources Conservation Co., Renton, Wash.
H. Herrigel, T. O'Neil, and T. Fosberg.
Available from the National Technical Information Service, Springfield, Va 22161 as PB-251-694, \$4.00 in paper copy, \$2.25 in microfiche. OWRT/S--76/30, June 1973. 42 p, 15 fig, 4 tab, 1 ref. DoI 14-30-2939.

Descriptors: *Desalination, *Distillation, *Vapor compression distillation, Evaporators, Chemical analysis, *Aluminum alloys.
Identifiers: Falling film, Solids concentration.

A long term test was conducted to demonstrate the ability of a vertical, plane surface, falling film, vapor compression evaporator to concentrate Roswell, N. Mex. brackish well water without scaling. The 14,000 mg/l TDS Roswell well water was concentrated 11 times to 145,000 mg/l TDS and a 17,500 mg/l natural suspended solids level. The system operated for a total of 112 days during this test program with the longest continuous run being 77 days. The tests were successful in demonstrating the long term effectiveness of the process and equipment.

OPERATING DATA OF A VERTICAL PLANE SURFACE, FALLING FILM EVAPORATOR USING SLURRY AND HIGH CONCENTRATION FEEDS,

Resources Conservation Co., Renton, Wash.
H. Herrigel, T. Fosberg, W. Stickney, and C. Perry.
Available from the National Technical Information Service, Springfield, Va 22161 as, PB-251-695, \$5.50 in paper copy, \$2.25 in microfiche. OWRT/S--76/27, October 1972. 102 p, 29 fig, 11 tab, append. DoI 14-30-2939.

Descriptors: *Brackish water, *Corrosion control, Operations, *Scaling, *Evaporators, *Desalination, Design.
Identifiers: Boiling point elevation, pH control, Falling film evaporation, Seeding processes.

Demonstration tests with a 5,000 gpd Laboratory Research Unit (LRU) substantiated the ability of a vertical, plane surface, falling film evaporator to take Roswell, N. Mex. brackish, well water to high concentrations without scaling. Two series of test conditions were run, each for a period of approximately 20 days. Tests were run at about 11 concentrations and at 25 concentrations over a range of condensing temperatures. Heat transfer coefficients above 1,000 Btu/hr-ft²-F degrees were consistently achieved throughout the tests. Process conditions were identified and verified for scale-free operation. A conceptual design and economic study of a 2.5 mgd plant (based on feed rate)

showed that 90 percent of the Roswell brine could be converted to fresh water at a recovery rate of 24.7 pounds of water per 1,000 Btu. Ninety-six percent conversion may be achieved at an overall rate of 22.3 pounds per 1,000 Btu with increased capital costs. Cost of product water from the 2.5 mgd plant is \$2.08/1,000 gallons for 96 percent conversion.

COMPUTATIONAL METHODS APPLICABLE TO THE COUPLED VTE/MSF DISTILLATION SYSTEM,

Electronic Associates, Inc., West Long Branch, N. J.
B. T. Fairchild, and C. S. Rhee.
Available from the National Technical Information Service, Springfield, Va 22161 as PB-251-640, \$5.00 in paper copy, \$2.25 in microfiche. OWRT/S--76/25, September 1973. 80 p, 4 fig, 10 tab. DoI 14-30-2845.

Descriptors: *Desalination, *Distillation, *Evaporators, Flash distillation, *Computer models, *Simulation analysis.
Identifiers: *VTE/MSF distillation system, Process variables, Flash stage, Vertical tube effect.

The Orange County Plant was selected initially as an example of a VTE/MSF system for the current study. However, before completion, it was directed that the Freeport Test Bed Plant be implemented. Since the computer programs were structured in a modular fashion, the contract effort was easily diverted. The vertical tube effect/multistage flash portion of the Freeport Test Bed Plant is simulated to provide steady-state profiles of all important process variables for a variety of process specifications. Mathematical models are developed for a flash stage, a vertical tube effect, a vapor flow stream, and a brine heater. Those components are combined for the Freeport Plant, and appropriate convergence schemes are applied to obtain consistent solutions. Computer programs are structured in a modular fashion such that similar systems may be conveniently implemented. For the current study, emphasis is not placed on generation of extensive steady state results, but rather on demonstration of a capability for producing consistent steady state results for a variety of process specifications.

VERTICAL TUBE DISTILLATION DESALTING, STATE-OF-THE-ART (1971), NOMOGRAPH BOOKLET.

Hittman Associates, Inc., Columbia, Md.
Available from the National Technical Information Service, Springfield, Va 22161 as PB-251-687, \$5.00 in paper copy, \$2.25 in microfiche. OWRT/S--76/24, January 1972. 58 p, 17 tab, 22 ref. DoI 14-01-001-1748.

Descriptors: *Desalination, *Distillation, *Evaporators, *Capital costs, Data collections.
Identifiers: *Vertical Tube Evaporators, *Process parameters, Product water cost, *Nomographs.

A series of nomographs were prepared which evaluate the cost and process parameters of vertical tube evaporator plants. The data used to compile these nomographs was taken from a series of Office of Saline Water R and D Reports, published articles, manufacturers information and actual plant data related to the process and its economics. The Economic data has been updated to a late 1971 base by use of engineering cost indices. Process parameter relationships utilized were updated in accordance with latest desalination data. The purpose of these nomographs is to allow estimates to be made concerning various cost and design parameters related to the vertical tube evaporator (VTE) process. Utilization of the nomographs will allow estimates of the cost of water, plant capital costs, cost of energy, and plant tubing area to be made.

Field 3—WATER SUPPLY AUGMENTATION AND CONSERVATION

Group 3A—Saline Water Conversion

W76-06254

VERTICAL TUBE DISTILLATION DESALTING, STATE-OF-THE-ART (1971).

Hittman Associates, Inc., Columbia.

Available from the National Technical Information Service, Springfield, Va., 22161, as PB-224 277, \$6.75 in paper copy, \$2.25 in microfiche. OWRT/S-76/23, November 1972. 142 p, 25 fig, 17 tab, 79 ref. DOI 14-01-001-1748.

Descriptors: *Evaporators, Flash distillation, *Desalination plants, *Distillation, Reviews, Performance.

Identifiers: Concentration ratios, *Vertical tube evaporators.

The state-of-the-art design, performance, and economics of downflow thin film vertical tube evaporator (VTE) desalting plants were analyzed and reviewed. Both single- and dual-purpose plants ranging in size from 1 to 250 MGD capacity were evaluated. The VTE has been in use for some time, but its application in large scale desalting projects is only 10 years old. The largest U.S. commercial plant is 1 GD (11 effects at a performance ratio of 9.3) and the largest experimental test bed is also 1 MGD (17 effects, performance ratio of 13.2). Designs ranging up to 250 MGD have been prepared. Recent innovations include integration of multistage flash (MSF) preheaters with the VTE equipment yielding apparent economies in materials, fabrication, and operation. Current technology emphasizes the use of enhanced surfaces for improvement of evaporation/condensation heat transfer. Concrete lined steel appears to offer long term corrosion resistance to hot seawater brines. Current plants and designs yield from 0.75 to 0.85 pounds of product water per 1000 Btu (initial heating steam) per effect at concentration ratios of 2.5 to 3.0. Two and three inch diameter evaporator tubes of Al-brass or 90-10 CuNi currently are the most attractive materials.

W76-06255

THE CONTROL AND OPERATION OF NUCLEAR DESALINATION SYSTEMS.

New South Wales Univ., Kensington (Australia). School of Nuclear Engineering.

L. G. Kemeny.
Journal of Hydrology (Amsterdam), Vol. 28, No. 2/4, p 449-468, February 1976. 7 fig, 3 tab, 12 eq, 7 ref, 2 append.

Descriptors: *Water resources, *Desalination plants, Operations research, Control, Optimization, Economics, Nuclear energy, Monitoring, Equations, Economics, Water treatment.

Identifiers: *Nuclear desalination systems.

The operation, control, and optimization of desalination plants in which the prime source of energy is derived from nuclear fuel and in which the sea or bore water is evaporated in multi-stage flash evaporator units presents no new scientific or technological. The unresolved difficulties associated with this technique are to be found more in the general fields of chemical control, corrosion prevention, and long term reliability. Herein, the 'desalination system' is assumed to consist of: (1) nuclear steam raising; (2) numerous multi-stage flash evaporator units; and (3) chemical water treatment plant. For non-technical reasons, only typical cases of plants in the ten to one hundred million gallon per day output size are considered, and specific references to nuclear system designs and operating flash evaporator installations are avoided. The paper is a condensed version of a manuscript which will be submitted for publication elsewhere. Discussed are system operation, characteristics of a typical plant, flash evaporator diagnosis, system control, nuclear plant dynamics (including nuclear time constants and boiler primary heat balance), and system optimization. In conclusion, a medium sized plant of the type described may be economically justified if built in

Australia only after the most detailed cost optimization. (Bell-Cornell)

W76-06426

HYDROLOGIC EVALUATION OF SALINITY CONTROL AND RECLAMATION PROJECTS IN THE INDUS PLAIN, PAKISTAN--A SUMMARY.

Geological Survey, Reston, Va.

For primary bibliographic entry see Field 5G.

W76-06453

AUTOMATIC WATER DISTILLER.

For primary bibliographic entry see Field 5F.

W76-06469

EVAPORATION APPARATUS OF SPECIAL MATERIAL.

Hooker Chemicals and Plastics Corp., Niagara Falls, N.Y. (Assignee).

For primary bibliographic entry see Field 5D.

W76-06482

PRELIMINARY ENGINEERING ANALYSIS, YUMA DESALTING PLANT.

Burns and Roe, Inc., Paramus, N. J.

Available from the National Technical Information Service, Springfield, Va 22161 as PB-251 873, \$7.50 in paper copy, \$2.25 in microfiche. OWRT/S-76/33, November 1974. 175 p, 14 fig, 19 tab, 2 append. 14-30-3270

Descriptors: *Desalination, *Desalination processes, *Membrane processes, Reverse osmosis electrodialysis, *Water treatment, Brackish water, *Irrigation, *Return flows, Cost analysis, Salinity control, Arizona, Colorado River.

Identifiers: Yuma Desalting Plant, Yuma Arizona, Lime softening process, Plant control membrane replacement criteria.

An evaluation was made of alternate membrane desalting and pretreatment processes, including cost estimates, for the 100 mgd Yuma Desalting Plant. Recommendations were also derived on procurement procedures, guarantee provisions, plant control and membrane replacement criteria. Both electrodialysis and reverse osmosis were considered for this application because of the salinity range projected for the Wellton-Mohawk drain water which would serve as the feed to the desalting plant. The lime softening process with solids contact reactors and dual media gravity filters was selected as the best pretreatment system. An additional advantage of the lime softening process is that reduction of the calcium and total dissolved solids increases the safety margin for scale formation permitting temporary higher recoveries, if necessary, to maintain salt balance. The analysis concluded that the final plant configuration for the constructed desalting plant would be determined by competitive bidding and that more than one manufacturer will probably be supplying equipment for the final plant. Accordingly, a base case design and cost estimate was developed for a plant equally split, on the basis of salt removed between hollow fiber reverse osmosis, spiral wound reverse osmosis and electrodialysis.

W76-06547

10,000,000 GALLON PER DAY SECONDARY REFRIGERANT FREEZE DESALTING PLANT.

Dravo Corp., Pittsburgh, Pa. Blaw-Knox Chemical Plants Div.

Available from the National Technical Information Service, Springfield, Va. 22161 as PB-251 906, \$7.50 in paper copy, \$2.25 in microfiche. OWRT/S-76/32, June 29, 1973. 121 p, 32 fig, 52 tab. DOI 14-30-3160

Descriptors: *Desalination processes, *Freezing, Sea water, Heat transfer, *Desalination plants, Potable water, Water treatment.

Identifiers: Butane, Direct contact, Continuous process.

This report describes a continuous process for producing potable water from sea water by partial freezing. Ice slurry is produced in a freezer by direct contact of sea water with liquid butane at the pressure slightly below atmospheric at which butane boils at the temperature of freezing saline water, deriving its heat for vaporization from ice formation. The resulting slurry of ice in brine is sent to a washer, where the ice is washed substantially free of salt, using part of the melted ice as the wash liquid. Washed ice is then melted by direct contact with slightly compressed butane vapor from the freezer. Butane condenses as it melts the ice, and condensate is recycled to the freezer. Cold from the potable water and product brine stream is recovered in the incoming feed by a heat interchange system employing vaporization and condensation of butane in direct contact with the aqueous streams. Since the system operates below ambient temperature and since heats of compression and pumping and heat in the feed sea water must be removed, heat is pumped from the system by compressing butane vapor not condensed in the melter to a pressure at which it can be condensed by the existing product streams.

W76-06549

A STANDARDIZED PROCEDURE FOR ESTIMATING COSTS OF SALINE WATER CONVERSION.

Office of Water Research and Technology, Washington, D. C.

Available from the National Technical Information Service, Springfield, Va 22161 as PB-251 888, \$4.50 in paper copy, \$2.25 in microfiche. OWRT/S-76/31, March 1956. 45 p, 17 fig, 4 tab, 20 ref.

Descriptors: *Desalination, *Desalination processes, *Comparative costs, *Engineers estimates, *Estimated costs.

Identifiers: *Cost estimating procedures, Standardized costing procedures.

This report presents a standardized procedure for making initial cost estimates for demineralization of saline waters by various processes. Any given estimate will not necessarily represent the cost of a process at a specific location but will represent the order of magnitude for the water cost under the assumed conditions and permit valid comparison of various processes. Cost estimates are first approximations based on selected costs for investment, fuel and power, with approximations for labor, supervision, maintenance, and other items. The standardized cost estimating procedure is presented in three parts, (1) a summary of the items in tabular form for estimating the costs, (2) a discussion of the many factors contributing to the cost estimating procedure, and (3) an appendix which includes cost estimates for various items of equipment, and analyses of saline waters.

W76-06550

SOLAR ENERGY TECHNOLOGY, STATE OF THE ART, AN ANNOTATED BIBLIOGRAPHY.

Ocean Engineering Information Service, La Jolla, Calif., Energy Resources Div.

E. Sinha, and B. McCosh.

Ocean Engineering Information Series Vol. 7,

(1975), 83 p.

Descriptors: *Bibliographies, Reviews, Solar distillation, Solar radiation, *Distillation, *Desalination, Energy, *Energy conversion, Heat transfer, Desalination plants, Desalination apparatus.

Identifiers: *Solar energy.

This bibliography contains 547 informative abstracts of the worldwide literature providing substantial scientific and technological information on the state-of-the-art of solar energy utilization. Subjects covered include: patents; equipment and

materials (photovoltaic cells, collectors, concentrators, materials); buildings (heating, cooling - air conditioning); electric power generation (photovoltaic conversion with electric storage, solar-thermal conversion with heat storage); total energy systems; space solar power stations (geosynchronous satellite solar power plant, microwave transmission to earth); solar sea power plants; bioconversion; special applications (agricultural, desalination, distillation, Industrial, navigation aids and naval facilities); energy conversion; energy storage; heat transfer; availability, climate, solar radiation measurement; economic analysis - costs; bibliographies; and geographic sites of special studies. The usefulness of the bibliography is enhanced by the inclusion of a subject outline which is supplemented with a keyterm index and an author index. References were selected from literature published during the past five years but a few older ones of special current interest are included. The bibliography is intended to serve as an interdisciplinary guide to the state of the art.

W76-06565

PRELIMINARY DESIGN OF A DIESEL-POWERED VAPOR-COMPRESSION PLANT FOR EVAPORATION OF SEAWATER, Oak Ridge National Lab., Tenn.

S. J. Senatore.
ORN-4049, Special, (OSW RDPR276), December 1966. 123 p, 13 ref. DoI 14-01-0001-534.

Descriptors: *Desalination plants, Sea water, *Evaporators, Evaporation, *Vapor compression distillation, Capital costs, Operating costs. Identifiers: *Vertical-tube evaporators.

The purpose was to determine whether the combination of a diesel engine or a gas turbine with a vapor compressor and a vertical-tube evaporator has good economic potential for desalting of seawater in plants of the 1- to 3-million-gallons-per-day (Mgd) range. The study concentrates on commercially available components which could be applied to a prototype or test bed plant with only a modest development effort. The study shows that the engine-driven vapor compressor-VTE concept has good potential for reducing the cost of distilled seawater in water-only plants of the size range 1 to 10 Mgd. The primary advantage of the system lies in its possibility of achieving heat economies of 20 to 27 lb product per 1000 Btu fuel consumption (for both heat and pumping energy), without the necessity of utilizing high brine temperatures or very low temperature differences. Alternative fuels are natural gas, diesel oil, or residual oil.

W76-06750

3B. Water Yield Improvement

WATER RELATIONS OF SELECTED SPECIES OF CHAPARRAL AND COASTAL SAGE COMMUNITIES,

San Diego State Univ., Calif. Dept. of Biology.
D. K. Poole, and P. C. Miller.
Ecology, Vol. 56, No. 5, p 1118-1128, Late Summer, 1975. 11 fig, 1 tab, 30 ref.

Descriptors: *Plant physiology, *Soil-water-plant relationships, *Moisture stress, *Turgidity, *Chaparral, *Sagebrush, Drought tolerance, Stomata, Moisture uptake, Moisture availability, Water balance, *California, Coasts, Semiarid climates, Shrubs, Soil moisture. Identifiers: *Artemisia californica*, *Sclerophylls*, *Arctostaphylos glauca*, *Ceanothus greggii*, *Rhus ovata*, *Rhus laurina*, *Rhus integrifolia*, *Adenostoma fasciculatum*, *Heteromeles arbutifolia*.

Water potentials, leaf resistances to water loss, and relative saturation deficits of selected shrub species were measured from June 1973 through May 1974 at coastal and inland sites in southern

California. Both the chaparral and coastal sage communities occur in a semiarid Mediterranean-type climate characterized by hot, dry summers and cool, wet winters. By December, the drought-deciduous *Artemisia californica* had water potentials less than -65 bars. The evergreen species *sclerophylls* was divided into 3 categories: (1) *Arctostaphylos glauca* and *Ceanothus greggii* developed lowest water potentials (less than -65 bars) and showed stomata least responsive to water potential, (2) *Rhus ovata*, *Rhus laurina*, and *Rhus integrifolia* had highest water potentials (about -25 bars) and stomata most responsive to water potential, and (3) *Adenostoma fasciculatum* and *Heteromeles arbutifolia* exhibited intermediate water potentials and stomatal responses. Water stress occurred earlier in the summer at the coastal site because of less rainfall. Where competition was most severe (on north facing slopes), soil moisture was reduced earlier in the summer and as a result, soil moisture content and plant water potentials were higher on the south-facing slope at the inland site. (Robinet-Arizona)

W76-06259

MORE WATER FOR ARIZONA.

Arizona Water Resources Committee, Phoenix; and Arizona Water Commission, Phoenix.
September 1974. 28 p, 18 fig, 1 tab.

Descriptors: *Water yield improvement, *Arizona, *Water resources, *Water harvesting, *Watershed management, *Surface runoff, Water conservation, Water yield, Runoff, Snowpacks, Vegetation effects, Forest management, Water supply, Groundwater resources, Recreation, Lumber.

Arizona's current annual water demand is about 7 million acre-feet, of which about 2 million comes from surface water sources and the remaining 5 million from pumped groundwater. Of this 5 million from groundwater, about 2 or 3 million acre-feet is overdrought. Arizona's water supply for municipal, industrial, agricultural and recreational uses can be increased significantly by management of vegetation on watersheds. Often, the same management practices which produce such increases will also result in improved production of timber, forage and water for livestock and game, and recreational values. An improvement of the aesthetic aspects of the land plus alleviation of such problems as fire control and soil erosion are also realized in many cases. As much as 1,200,000 acre-feet of water a year on the average could be harvested to supplement Arizona's present supply of surface water. Before initial judgments can be made as to whether or not a given watershed can be made more productive, a comprehensive inventory of data on precipitation, slope angle, soil type and depth, vegetation densities, and existing priorities of land use and values is necessary. In addition, there still remains the scientific need for the development of reliable means to extrapolate information gained from small experimental plots to large, operational areas. (Robinet-Arizona)

W76-06261

WATER-SAVING DEVICES: THE STATE OF THE ART,

Pennsylvania State Univ., University Park. School of Forest Resources.
For primary bibliographic entry see Field 3D.
W76-06317

METHOD FOR COLLECTING SCALE FORMATIONS IN WATER PIPES.

Key II Industries, Camarillo, Calif. (Assignee).
For primary bibliographic entry see Field 8G.
W76-06479

LARGE SCALE EFFECTS OF CLOUD SEEDING,

Aerometric Research, Inc., Goleta, Calif.
K. J. Brown, R. D. Elliott, and J. R. Thompson.

Report ARI 75-2, June 1975. 230 p, 30 fig, 4 tab, 28 ref, 8 append. 14-06-D-6841.

Descriptors: *Weather modification, Precipitation (Atmospheric), *Cloud seeding, Cloud physics, Rainfall.

At the conclusion of a nine year study to determine the Large Scale Effects of Cloud Seeding, the statistical evidence indicates that modification of precipitation patterns over a large area is a persistent feature in all of the winter orographic seeding programs studied. The most frequent location for these extra-area effects is 150-200 km from the seeding source and 20 to 40 deg to the right of the 700 mb wind flow. The extra-area effect is always of the same sign and generally slightly larger in magnitude than the primary seeding effect. It is hypothesized that the major extra-area enhancement of precipitation occurs during those portions of orographic storms containing organized convection. The increase in precipitation would be due to an enhancement of convective activity by conversion of water to ice with attendant changes in meso-scale circulation patterns which result in prolonging the convective activity. A secondary zone of enhanced precipitation frequently appears about 150-200 km downwind from the seeding source. This area appears to be merely an extension of the primary seeding effect due to the long trajectory of small ice crystals produced by seeding. The quantity of precipitation produced in this area is small and only detectable when it occurs in a normally arid region. (Bureau of Reclamation)

W76-06562

COLORADO RIVER BASIN PILOT PROJECT, FINAL COMPREHENSIVE OPERATIONS REPORT, 1970-1975 SEASON,

EG and G, Inc., Durango, Colo. Environmental Services Office.
L. M. Hjermstad.
Report AL-1200, Dec. 23, 1975. 161 p, 41 fig, 31 tab. 14-06-D-6963

Descriptors: *Artificial precipitation, Atmosphere, *Colorado, *Cloud seeding, Clouds, Forecasting, Meteorology, Nucleation, Orography, River basins, Silver iodide, Snow, Snowpack, Storm structure, *Weather modification, Colorado River Basin, Precipitation (Atmospheric).
Identifiers: San Juan Mountains (Colo).

Operational aspects are summarized of five winter seasons of weather modification research under the Colorado River Basin Pilot Project. The program was a randomized research seeding program under the direction of the Bureau of Reclamation. All aspects of the program design, field equipment, operational criteria plan, opportunity recognition forecasting, and seeding operations for the five operational seasons are reviewed. Evaluation of experimental data collected during the operational periods of the program indicate that the orographic cloud systems over the San Juan Mountains respond to seeding with silver iodide similar to orographic cloud systems seeded in the vicinity of Climax, Colorado. (Bureau of Reclamation)

W76-06564

WATER HARVESTING: STATE OF THE ART, Agricultural Research Service, Phoenix, Ariz. Water Conservation Lab.

K. R. Cooley, A. R. Dedrick, and G. W. Frasier.
Watershed Management, Proceedings, August 11-13, 1975, Logan, Utah. Irrigation and Drainage Div. American Society Civil Engineers, N. D., p. 1-20, 81 ref.

Descriptors: *Water harvesting, *Water yield improvement, *Vegetation effects, *Land forming, *Soil treatment, Rainfall-runoff relationships, Rain water, Runoff, Soil types, Soil sealants, Precipitation (Atmospheric).
Identifiers: Water storage, *Reviews.

Field 3—WATER SUPPLY AUGMENTATION AND CONSERVATION

Group 3B—Water Yield Improvement

Water harvesting depends on natural precipitation and is therefore limited to areas where precipitation is sufficient and variability is not excessive. The particular water harvesting method used to collect precipitation depends on several factors including soil type and depth, vegetative cover, surface roughness and slope, climatic factors, land, labor, and material costs, water use rate and distribution, water quality desired, and availability of materials. Commonly used methods are vegetation management, land alteration, chemical or physical soil treatments, and soil covers. Annual precipitation in excess of 280 mm is generally required for successful vegetation management results with runoff yield increasing as annual precipitation increases. Land alteration is especially attractive where impervious areas already exist and only collection and storage facilities are required. Land alteration is economically feasible in areas where labor costs are low and soil conditions are suitable. Successful chemical and physical soil treatments have been applied to certain soils, but more research is needed to delineate the conditions under which each can be used. Soil covers are generally not restricted by soil and climatic conditions but usually have a higher initial cost than other methods. Water collected from catchments can be stored in the soil, excavated ponds, bags, or tanks. (Robinett-Arizona) W76-06584

SALT CEDAR (TAMARIX CHINENSIS) SEED PRODUCTION, SEEDLING ESTABLISHMENT, AND RESPONSE TO INUNDATION. Geological Survey, Tucson, Ariz. D. K. Warren, and R. M. Turner. Journal of the Arizona Academy of Science, Vol. 10, No. 3, p. 135-144, October, 1975. 11 fig, 1 tab, 13 ref.

Descriptors: *Tamarisk, *Riparian plants, *Seeds, *Plant growth, *Submergence, *Reproduction, *Phreatophytes, *Vegetation effects, *Plant physiology, *Resistance, *Germination, *Willow trees, *Cottonwoods, *Arizona. Identifiers: San Carlos Reservoir (Ariz), San Pedro River (Ariz).

Salt cedar has become established in large areas around reservoirs, streams, and rivers, notably in the arid southwest, since its introduction into the U.S. Although reasons for its replacement of native riparian species are not fully known, observations indicate that a high rate of seed production and an effective means of dissemination have, in part, led to salt cedar's rapid spread. The plant's ability to survive long periods of inundation and to invade as water recedes have probably been additional factors in its spread around reservoirs. Studies were conducted along the shore of the San Carlos Reservoir and on the San Pedro River in southeastern Arizona. Seed production in a dense stand of salt cedar yielded 17 seeds per square centimeter during the 5 1/2 month seed producing season. This seed production was compared with seed production in two native riparian species, seepwillow (*Baccharis glutinosa*) and cottonwood (*Populus fremontii*). The rate of establishment of salt cedar seedlings on the banks of a reservoir with receding water level corresponded closely to the rate of seed production of nearby plants. Greatest seedling establishment occurred between early May and mid-June. Mature salt cedar plants were able to survive complete submergence for as long as 70 days, and without complete submergence, up to 98 days. (Robinett-Arizona) W76-06590

MANAGING CHAPARRAL FOR WATER AND OTHER RESOURCES IN ARIZONA. Forest Service (USDA), Tempe, Ariz. Rocky Mountain Forest and Range Experiment Station. A. R. Hibbert, E. A. Davis, and T. C. Brown. In: Watershed Management, Proceedings Irrigation and Drainage Division American Society of Civil Engineers, August 11-13, 1975, Logan, Utah, p. 445-468. 8 fig, 30 ref.

Descriptors: *Chaparral, *Watershed management, *Water yield improvement, *Vegetation effects, *Surface runoff, *Arizona, *Livestock, *Water supply, *Water quality, *Forages, *Erosion, *Revegetation, *Land development, *Water harvesting, *Land management, *Water yield, *Vegetation, *Grasslands, *Grasses.

The chaparral vegetation type of the interior Southwest is found almost exclusively in Arizona, where it occupies some 3 to 4 million acres of rough, broken terrain in the central part of the state. While land managers rate chaparral low in commercial value, it yields about 0.1 acre-foot of good quality water per acre per year, and produces forage and browse for big game and livestock. Because of a dwindling water supply in central Arizona, conversion of chaparral to grass has been considered as a means to augment streamflow. The key to increasing water yield is replacement of deep-rooted shrubs with shallow-rooted grasses and forbs. Shrub roots ramify the entire soil mantle and can deplete the soil-water reserve to a greater extent than grasses and forbs. In previous experiments on treated watersheds, streamflow increased from 28 percent in open brush with low rainfall to more than 300 percent in dense brush with high rainfall. Conversion practices may affect water quality by temporarily increasing suspended sediment and nutrient loads, and by contamination with herbicides. It is probable that erosion will increase for a time following most conversion practices with the greatest erosion from broadcast burning and the least from mechanical and chemical control of shrubs if replacement cover is established soon after treatment. Assuming that large-scale conversion techniques can be successfully applied, and that 735,000 acres of chaparral would eventually be converted to grass, the expected downstream increase would average about 150,000 acre-feet each year. (Robinett-Arizona) W76-06597

VEGETATION MANAGEMENT FOR WATER AND RANGE IMPROVEMENT. Arizona Univ., Tucson. School of Renewable Natural Resources. P. F. Ffolliott, and D. B. Thorud. In: Watershed Management, Proceedings Irrigation and Drainage Division American Society of Civil Engineers, August 11-13, 1975, Logan, Utah, p. 249-266. n.d. 16 ref.

Descriptors: *Watershed management, *Water yield improvement, *Surface runoff, *Vegetation effects, *Land management, *Arizona, *Erosion control, *Forest management, *Water yield, *Vegetation, *Range management, *Coniferous forests, *Ponderosa pine trees, *Juniper trees, *Pinyon pine trees, *Chaparral, *Grasslands, *Desert plants, *Riparian plants, *Water harvesting. Identifiers: *Vegetation management.

A review is presented of current water yield improvement experiments in Arizona in order to illustrate ways to enhance the beneficial and reduce the detrimental effects of vegetation management re-directions on water and herbage production. Seven vegetation zones are considered distinguishable for characterizing and describing water yield improvements and include mixed conifer forests, ponderosa pine forests, pinyon-juniper woodlands, chaparral vegetation zone, grassland vegetation zone, desert shrub vegetation zone, and riparian association zone. The vegetation management re-directions evaluated have potential for increased water and herbage production while reducing detrimental effects of sedimentation and erosion. It seems possible that vegetation management systems can be aimed at satisfying increasing demands for water and herbage production and also minimize the destruction of on-site resources. (Robinett-Arizona) W76-06598

CASCADE ATMOSPHERIC WATER RESOURCES PROGRAM, VOLUME 1. Washington State Dept. of Ecology, Olympia. P. V. Hobbs, L. F. Radke, A. B. Fraser, J. D. Locatelli, and C. E. Robertson. Report No. VI, May 1, 1975, 306 p. 14-06-D-6999

Descriptors: *Artificial seeding, *Mountains, *Storms, *Orographic clouds, *Precipitation (Atmospheric), *Snowfall, *Weather modification, *Washington, *Cyclones, *Cloud seeding. Identifiers: *Cascade Mountains (Wash).

Studies of winter cyclonic storms, orographic clouds, and precipitation over the Cascade Mountains of Washington State are described. During the July 1970-June 1971 period simultaneous airborne, ground and radar observations were made in a number of different synoptic situations, and investigations into the effects on clouds and precipitation of seeding with artificial ice nuclei were continued. Progress was also made in developing a theoretical model to describe the flow of air over the Cascade Mountains and the growth and fall-out of precipitation from orographic clouds. (See also W76-06601 and W76-06602) (Bureau of Reclamation) W76-06600

CASCADE ATMOSPHERIC WATER RESOURCES PROGRAM, VOLUME 2. Washington State Dept. of Ecology, Olympia. P. V. Hobbs, L. F. Radke, J. D. Locatelli, D. G. Atkinson, and C. E. Robertson. Report No. VII, May 1, 1975, 293 p.

Descriptors: *Artificial seeding, *Mountains, *Orographic clouds, *Snowfall, *Weather modification, *Washington, *Precipitation (Atmospheric), *Cloud seeding. Identifiers: *Cascade Mountains (Wash).

Detailed theoretical and field investigations are described of winter cloud and precipitation systems over the Cascade Mountains of Washington State carried out during 1971-72. Highlights include further developments of a theoretical model for orographic clouds and precipitation, results of an extensive set of measurements on the concentrations of ice particles in natural clouds, a discussion of the factors which affect the aggregation of ice particles, five case studies (two described in detail) of the effects of artificial seeding on clouds and precipitation, and a preliminary evaluation of the reliability of artificial seeding for the controlled redistribution of snowfall in the Cascade Mountains. (See also W76-06600 and W76-06602) (Bureau of Reclamation) W76-06601

EFFECTS OF CLOUD SEEDING ON SUMMER-TIME PRECIPITATION IN NORTH DAKOTA. South Dakota School of Mines and Technology, Rapid City, Inst. of Atmospheric Sciences. A. S. Dennis, J. R. Miller Jr, E. I. Boyd, and D. E. Cain. Report 75-1, March 1975. 14-06-D-6660

Descriptors: *Cloud physics, *Cloud seeding, *Clouds, *Hail, *Ice nuclei, *North Dakota, *Radar, *Rainfall, *Silver iodide, *Statistics, *Weather modification, *Monte Carlo method, *Precipitation (Atmospheric).

A randomized pilot project was conducted from 1969 to 1972 to test effects of cloud seeding upon growing season precipitation in western North Dakota. The principal seeding method was the operation of silver iodide generators on aircraft below cloud base. Data were collected by radar, instrumented aircraft, rain gages, and passive hail indicators. The analysis provides evidence, significant at roughly the 5% level, that silver iodide seeding of convective clouds on a determinate set of days leads to (1) an increase in the frequency of rainfall events at the target gages, (2) an increase

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in the average rainfall recorded per rainfall event, and (3) an increase in total rainfall on the target. The set of days to which this evidence applies is those days with dynamic seedability, that is, days for which a cloud model predicted an increase in cloud top height under the influence of silver iodide seeding. Rainfall observations on days when the cloud model predicted no increase in cloud height show no significant differences between seed and no-seed days. The hailfall data show less hail on seed than on no-seed days but the difference is not statistically significant. (Bureau of Reclamation)
W76-06603

THE POTENTIAL FOR RAINFALL INCREASES FROM CONVECTIVE CLOUDS IN THE NORTHERN PLAINS,

South Dakota School of Mines and Technology, Rapid City. Inst. of Atmospheric Sciences. A. S. Dennis, J. H. Hirsch, D. E. Cain, J. R. Miller, Jr., and A. Koscielski.
Report 75-12, September 1975. 14-06-D-6796

Descriptors: *Model studies, Cloud physics, *Cloud seeding, Cumulus clouds, Radar, Rain, Rain gages, Silver iodide, Statistical analysis, Monte Carlo method, *Weather modification, Precipitation (Atmospheric), *North Dakota, Rainfall.
Identifiers: Northern Plains (No Dak).

Investigations using data collected during field experiments in cloud seeding over the past ten years are described. The sets of data used are the Cloud Catcher 10-cm radar for 1971-72, the rainfall records from the Rapid Project of 1966-68, and from the North Dakota Pilot Project (NDPP) for 1971-72, and time-lapse radar photographs obtained on the NDPP in 1972. A one-dimensional, steady-state cloud model has been used extensively in all three investigations. The 10-cm radar data from Project Cloud Catcher are analyzed for the first time in terms of individual cells rather than test cases as a whole. The Cloud Catcher cases of 1971-72 were randomly assigned to seed and no-seed categories with salt being the usual seeding agent. A comparison of 41 cells drawn from the seed population and 16 drawn from the no-seed population shows no difference in cloud depth but suggests significant differences in some other variables. The Rapid Project was a randomized crossover experiment with separate target areas for southwest and northwest flow days. Consideration was given to average daily rainfall in each target area. A study of shower echoes on the North Dakota Pilot Project for 1972 shows most of the cloud depths from 4 to 10 km. Cloud model runs suggest considerable dynamic seedability for clouds 3 to 6 km deep. (Bureau of Reclamation)
W76-06607

THE MEDICINE BOW ECOLOGY PROJECT: THE POTENTIAL SENSITIVITY OF VARIOUS ECOSYSTEM COMPONENTS TO WINTER PRECIPITATION MANAGEMENT IN THE MEDICINE BOW MOUNTAINS, WYOMING, Wyoming Univ., Laramie.
For primary bibliographic entry see Field 5C.
W76-06610

CLOUD SEEDING TO ENHANCE SUMMER RAINFALL IN THE NORTHERN PLAINS, South Dakota School of Mines and Technology, Rapid City. Inst. of Atmospheric Sciences. A. S. Dennis, P. L. Smith, Jr., B. L. Davis, H. D. Orville, and R. A. Schleusener.
Report No. 74-10, (1974).

Descriptors: Convection clouds, Cloud physics, *Cloud seeding, Computer models, *Cumulus clouds, Hail, Ice nuclei, Nucleation, Silver iodide, *Weather modification, *South Dakota, Water yield improvement.
Identifiers: *Northern Great Plains (So Dak).

Convective clouds are controlled by moisture supply, atmospheric instability, topographic features, and the convergence or divergence in the low level wind field. Precipitation forms in convective clouds through both the coalescence of liquid droplets and the action of frozen precipitation embryos. Both precipitation processes can be induced or modified by artificial means, the coalescence process by hygroscopic seeding, and the ice phase process by introduction of dry ice or silver iodide crystals to the supercooled portions of the cloud. Silver iodide seeding from aircraft in updrafts below cloud base using acetone generators charged with a silver iodide-ammonium iodide solution is recommended as an effective and relatively economical seeding method. Both salt and silver iodide seeding increase the horizontal extent of showers and total rainfall from them. Rainfall increases by silver iodide seeding include a component related to dynamic effects caused by the release of latent heat by artificial freezing of supercooled cloud water. (Bureau of Reclamation)
W76-06612

SATELLITE SUPPORT TO THE HIPLEX ACTIVITIES FOR 1975,

Colorado State Univ., Fort Collins. Dept. of Atmospheric Science. D. W. Reynolds, T. H. Vonder Haar, J. J. Gailium, and D. W. Hillger.
Final report, December 1975. 137 p, 62 fig, 9 tab, 20 ref. USBR 14-06-D-7630.

Descriptors: Satellites (Artificial), *Weather modification, Climatology, *Kansas, *Remote sensing, *Clouds, *Climatic data, Data collections, Precipitation (Atmospheric).
Identifiers: Miles City (Kan), Colby-Goodland (Kan), Big Spring (Kan).

Final results of a cloud climatology composite developed using ATS-3 satellite imagery for three HIPLEX sites (Miles City, Colby-Goodland, Big Spring) are presented. Case study results demonstrate the usefulness of satellite data in determining cloud heights, organization, life time compared to radar, size compared to echo size, and show how satellite sounder data can extend conventional radio-sonde data in both space and time. Three years of ATS-3 satellite data were also examined and a subjective classification of mesoscale and synoptic weather features were compiled for the three HIPLEX sites and the northern, central and southern high plains. Also, five years of WBAN-10 hourly observations were analyzed and a climatological composite of both convective cloud and precipitation occurrences were compiled. These results are a preliminary look into how satellites can support the HIPLEX experiment. Digital and imagery data gathered from the SMS-2 satellite should increase knowledge of how satellites can support the HIPLEX. (Bureau of Reclamation)
W76-06613

THE IMPACT OF OVERWINTER DRAWDOWN ON THE AQUATIC VEGETATION OF THE CHIPPEWA FLOWAGE, WISCONSIN, Wisconsin Univ., Madison. Environmental Resources Extension.
For primary bibliographic entry see Field 4A.
W76-06711

ECOLOGICAL EFFECTS OF WEATHER MODIFICATION: EFFECT OF LATE SNOW-MELT ON FESTUCA IDAHOENSIS ELMER MEADOWS, Montana State Univ., Bozeman. Dept. of Biology. T. Weaver.
Am Midl Nat. 92(2), p346-356, 1974.

Descriptors: Ecology, Environmental effects, *Fescues, *Snowmelt, *Grasslands, *Weather modification, Ground cover, Seasonal, Soils.
Identifiers: Festuca-Idahoensis.

Diversity, cover and productivity of *F. idahoensis* meadows become progressively lower as one moves from deep-soil to shallow-soil sites, or from sites that melt out in mid-May to sites that melt in late May or early June. Changes in species composition are also obvious on late melting sites. Changes associated with different melt dates are probably due to the shorter growing season of the late melting sites. Winter weather modification programs are expected to add snow, postpone melt, shorten the growing season and degrade these meadows in proportion to the amount of snow they add. Especially if the snow is deposited in drifts, the 10-15% increases in snowfall probably achievable will have small effects on the 'target area' while returns to the 'service area' might be considerable. --Copyright 1975, Biological Abstracts, Inc.
W76-06756

3C. Use Of Water Of Impaired Quality

SEED GERMINATION, RESPIRATION AND MITOCHONDRIAL EFFICIENCY OF THREE ALFALFA (MEDICAGO SATIVA L.) CULTIVARS SUBJECTED TO NaCl SALINITY, Arizona Univ., Tucson. Dept. of Agronomy and Plant Genetics. M. Bar-Adon.

Descriptors: *Alfalfa, *Germination, *Respiration, *Salt tolerance, *Plant physiology, Seeds, Salinity, Water quality, Salts, Saline soils, Arid lands, Crop production, Sodium chloride, Osmotic pressure.
Identifiers: *Mitochondrial efficiency, Ladak 65, Mesa-Sirsa, Salton, Respiratory control.

Salinity is one of the major factors causing yield reduction of agricultural crops in arid and semiarid regions, as low rainfall and high temperatures prevent adequate leaching of soluble salts. The germination percentage, seedling respiration, mitochondrial efficiency and respiratory control of Ladak 65, Mesa-Sirsa, and Salton alfalfa cultivars were evaluated under water potentials ranging from 0 to minus 10 bars. With increasing salt concentration, germination percentage of the three cultivars decreased; Salton had the greatest tolerance. NaCl salinity exerted both osmotic and toxic effects on the germinating seed. The highest respiration rates averaged over all salt concentrations were noted in Mesa-Sirsa which showed an increase in respiration rate when treated with minus 10 bars sodium chloride. Mitochondrial efficiency and respiratory control were polarographically measured from isolated mitochondria. At high salt concentrations both mitochondrial efficiency and respiratory control were higher than at low salt concentrations, with Ladak 65 having the highest mitochondrial efficiency and respiratory control followed by Mesa-Sirsa and Salton respectively. (Robinet-Arizona)
W76-06264

SALINITY-OZONE INTERACTIVE EFFECTS ON ALFALFA YIELD AND WATER RELATIONS, Agricultural Research Service, Riverside, Calif. Salinity Lab. G. J. Hoffman, E. V. Maas, and S. L. Rawlins.
Journal of Environmental Quality, Vol. 4, No. 3, p 326-331, July - September, 1975. 4 fig, 5 tab, 16 ref.

Descriptors: *Salinity, *Ozone, *Soil-water-plant relationships, *Alfalfa, Irrigation water, Saline water, *Crop production, Plant growth, Agriculture, Air pollution, Leaves.
Identifiers: Medicago sativa L. cv. Moapa, Leaf diffusion resistance.

The effect of ozone on forage yield of alfalfa (Medicago sativa L. cv. Moapa) was determined at four controlled salinity levels (NaCl and CaCl2)

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having osmotic potentials of -40, -200, -400, and -600 kilopascals. For nonsaline treatments, ozone greatly reduced yields when alfalfa was exposed to daily 2-hour periods of 10-20 parts per hundred million; concentrations that are prevalent in many agricultural areas. As salinity increased, ozone had less effect on yield, and a 25% greater yield was produced with salinity at moderate, but not detrimental levels. Salinity at all levels or ozone at 20 parts per hundred million increased water use efficiency of alfalfa, and low concentrations of ozone had no effect on water-use efficiency. Both ozone and salinity together were required to increase leaf diffusion resistance. (Robinet-Arizona) W76-06269

EFFECT OF SALINE WATER IRRIGATION ON N.CO310 AND H50-7209 CULTIVARS OF SUGARCANE: II. CHEMICAL COMPOSITION OF PLANTS, Hawaii Univ., Honolulu. Dept. of Agronomy and Soil Science. M. M. Syed, and S. A. El-Swaify. Trop Agric. 50(1), p 45-51, 1973.

Descriptors: *Sugarcane, *Saline water, Irrigation, Chlorides, Sea water, Sulfates, Sodium chloride, Sodium sulfate, Phosphorus, Potassium, Magnesium. Identifiers: Cultivars, H50-7209, Sodium.

The effects of saline water irrigation on the chemical composition of 2 sugarcane cultivars were determined. Salt types NaCl, Na₂SO₄ and sea water affected the uptake of various elements differently. In general, the Na content was increased by all treatments, K content remained unchanged with NaCl and sea-water irrigation but decreased with Na₂SO₄. Ca content was reduced, most of the reduction occurring under Na₂SO₄ irrigation, and Mg content increased slightly with the highest content noted under sea water treatments. Analysis for anions showed that Cl content increased significantly with NaCl and sea water irrigation but decreased sharply with Na₂SO₄, that the converse was true for SO₄ content, that P content remained essentially unchanged for N.Co.310 but increased significantly for H50-7209, and that N contents of blades were reduced under all treatments.—Copyright 1975, Biological Abstracts, Inc. W76-06274

EFFECT OF IRRIGATION REGIMES IN RELATION TO CHLORCHOLINE CHLORIDE (CCC) APPLICATION ON WHEAT, Cairo Univ., Giza (Egypt). Dept. of Agronomy; and Cairo Univ., Giza (Egypt). Faculty of Agriculture. For primary bibliographic entry see Field 3F. W76-06279

SEEDBED SOIL SALINITY AND EMERGENCE OF PEPPERS AND CARROTS UNDER SPRINKLER AND FURROW IRRIGATION, Agricultural Research Service, Weslaco, Tex. F. Salinas, and L. N. Namken. J Rio Grande Val Hort Soc. 27, p 74-80, 1973.

Descriptors: *Saline soils, *Carrots, *Sprinkler irrigation, *Furrow irrigation, Irrigation practices. Identifiers: *Peppers.

Seedbed soil salinity levels were affected by irrigation method during the establishment of sweet peppers and carrots. Soil salinity (ECE) in the surface 2.5 cm increased from 0.6 to 11.4 mmho/cm during the summer establishment of peppers under furrow irrigation compared with an increase from 0.6 to 3.5 mmho/cm under sprinkler irrigation. Soil salinity below 2.5 cm was the same for both irrigation methods. Sweet pepper populations before thinning were 170,000, 277,000 and 412,000 plants/ha under furrow, 3-5 day sprinkler and daily sprinkler irrigation treatments, respectively. The ECE in the surface 2.5 cm of the beds after the

establishment of fall carrots under furrow irrigation was 12.3 mmho/cm compared with 5.7 mmho/cm under sprinklers. Carrot populations after stand establishment irrigation were 250,000 and 288,000 plants/ha under furrow and sprinkler irrigation, respectively.—Copyright 1974, Biological Abstracts, Inc. W76-06305

THE FUTURE OF WATER RESOURCES, Wessex Water Authority, Bristol (England). For primary bibliographic entry see Field 5F. W76-06324

CHEMICAL COMPOSITION AND YIELD OF SOYBEANS AS AFFECTED BY IRRIGATION AND DEEP PLACEMENT OF LIME, PHOSPHORUS AND POTASSIUM, Virginia Polytechnic Inst. and State Univ., Blacksburg. Coll. of Agriculture. J. A. Lutz, Jr., G. D. Jones, and E. B. Hale. J Indian Soc Soil Sci. 21(4), p 475-483, 1973.

Descriptors: *Soybeans, Crop production, *Lime, *Phosphorus, *Potassium, Fertilizers, Irrigation.

The experiment conducted on Davidson clay loam consisted of treatment of 49 kg P/ha and 186 kg K/ha disked into the Ap layer in 1969 and 1970. Plow sole placement (30.5 cm) consisted of various rates and ratios of P and K with and without lime and micronutrients. Deep placement of lime and fertilizer did not affect the yield and quality of soybeans (Glycine max (L.) Merrill). Irrigation increased lodging, delayed maturity and significantly increased the yield of beans and hay each year. Leaf P and K, and the protein contents of beans were unaffected by irrigation. Oil content of beans was increased significantly with irrigation. Irrigation also significantly increased seed size and purple stain. The soil pH and available P, K, Ca and Mg of various soil depths were affected by lime, P and K treatments.—Copyright 1974, Biological Abstracts, Inc. W76-06338

HYDROLOGIC EVALUATION OF SALINITY CONTROL AND RECLAMATION PROJECTS IN THE INDUS PLAIN, PAKISTAN--A SUMMARY, Geological Survey, Reston, Va. For primary bibliographic entry see Field 5G. W76-06453

LOW DRIFT SPRAY NOZZLE, Delavan Manufacturing Corp., West Des Moines, Iowa. (Assignee) For primary bibliographic entry see Field 5G. W76-06467

PRELIMINARY ENGINEERING ANALYSIS, YUMA DESALTING PLANT, Burns and Roe, Inc., Paramus, N. J. For primary bibliographic entry see Field 3A. W76-06547

GROUNDWATER RESOURCES OF ALTUNKUPRI AREA, Institute for Applied Research on Natural Resources, Baghdad (Iraq). For primary bibliographic entry see Field 4B. W76-06576

A PROPOSAL FOR FUTURE UTILIZATION OF THARTHAR LAKE WATER, Institute for Applied Research on Natural Resources, Baghdad (Iraq). N. M. Ali Rashid, A. H. Al-Rawi, G. S. Toma, and R. K. Abdul-Halim. Technical Bulletin 74, October 1974. 35 p, 4 fig, 11 tab, 14 ref.

Descriptors: *Saline water, *Irrigation water, *Water supply, *Water quality, Brackish water, Irrigation, Salinity, Water demand, Dams, Storage requirements, Water resources development, Water shortage. Identifiers: *Tharthar Lake(Iraq), *Euphrates River, Tigris River, Habbaniya Lake(Iraq).

Construction of dams on the Euphrates river in Turkey and Syria has not only caused water shortages in the Euphrates river in Iraq, but has also increased the river's salinity. The use of Tharthar lake water, which is highly saline, has therefore become valuable for augmenting irrigation water in the central and southern parts of Iraq. However, in order to reduce the salinity hazard it was necessary to find the most suitable mixing ratio of Tharthar and Euphrates water. With respect to salinity and sulfate ion concentration, a mixing ratio of 0.25:1.00 of Tharthar to Euphrates water appears to be most suitable. Using this ratio about 6.442 billion cu m per year could be released from the lake to the Euphrates river. For flood control and during the period of October-February when irrigation demands are low, a higher mixing ratio of 0.5:1.0 is suggested. Results of chemical analysis of waters from the Tigris and Euphrates rivers and Tharthar and Habbaniya lakes indicate that water of the Tigris river has the best quality with respect to salt content, carbonates, sulfate content, and sodium adsorption ratio, followed by Habbaniya, Euphrates, and Tharthar waters. The sulfate concentration in Tharthar lake amounted to about 45 percent of the total ionic concentration. (Robinet-Arizona) W76-06577

SOIL MOISTURE REGIME OF UNSATURATED ZONE IN SOME ARID REGIONS, Institute for Applied Research on Natural Resources, Baghdad (Iraq). For primary bibliographic entry see Field 2G. W76-06578

INVESTIGATION OF SOME PHYSICAL PROPERTIES OF THE SOILS IN THE DALMAJ PILOT PROJECT AREA, Institute for Applied Research on Natural Resources, Baghdad (Iraq). For primary bibliographic entry see Field 2G. W76-06579

CHARACTERISTICS AND CLASSIFICATION OF TWO SOILS IN DIYALA BASIN, IRAQ, Institute for Applied Research on Natural Resources, Baghdad (Iraq). For primary bibliographic entry see Field 2G. W76-06580

DRAINAGE AND RECLAMATION PERFORMANCE AT THE IMAM EXPERIMENTAL FIELD IN THE GREATER MUSSAYEB PROJECT, A MONITORING STUDY, Institute for Applied Research on Natural Resources, Baghdad(Iraq). B. A. Takessian, and R. van Aart. Technical Bulletin 79, December, 1974. 15 p, 5 fig, 3 tab, 4 ref.

Descriptors: *Drainage engineering, *Irrigation effects, *Land reclamation, *Hydraulic conductivity, *Drainage systems, Soil-water-plant relationships, Soil moisture, Drainage practices, Arid lands, Infiltration, Soil investigations, Land management, Permeability, Irrigated land, Soil physical properties, Saturated soils. Identifiers: *Greater Mussayeb Project(Iraq).

The Greater Mussayeb Project is located about 65 km south of Baghdad and consists of some 80,000 hectares irrigated with Euphrates River water. In order to test the existing drainage systems with drain spacing of 333 m under improved farm conditions, a farm unit of 16.5 hectares, situated in a

transition zone between high levee and basin soil associations, was monitored for 3 years (1969-1972). Results indicated that under an average cropping pattern of 50 percent winter and 45 percent summer intensity the existing open drainage system was adequate to prevent water-logging and salinization of the land. Hydraulic conductivity measurements showed that to a depth of 3.5 m the soil is moderately to moderately rapid permeable with values ranging from 0.6 to 3.5 m/day and with an average of 1.5 m/day. Below 3.5 m the average permeability can be taken as 0.4 m/day. The average drainage requirement was calculated at 0.8 mm/day and the effective transmissibility was 20 sq m/day. (Robinet-Arizona)
W76-06581

EFFECT OF SALINIZATION ON CERTAIN SOIL MICROFLORA,
Institute for Applied Research on Natural Resources, Baghdad (Iraq).
For primary bibliographic entry see Field 5C.
W76-06582

SURFACE RUNOFF AND ITS EFFECT ON DIFFUSE SALT PRODUCTION FROM MANCOS SHALE MEMBERS,
Utah State University, Logan, Dept. of Civil and Environmental Engineering.
For primary bibliographic entry see Field 2G.
W76-06583

ESTIMATING INDIRECT COST OF URBAN WATER USE,
Koebig and Koebig, Inc., Los Angeles, Calif.
For primary bibliographic entry see Field 6C.
W76-06615

STUDIES ON THE EFFECT OF SOIL DENSITY, TEMPERATURE AND FERTILIZATION OF THE SOIL MOISTURE, VALUE OBTAINED WITH A DIELECTRIC MEASURING TECHNIQUE, (IN GERMAN),
For primary bibliographic entry see Field 2G.
W76-06727

THE INFLUENCE OF HIGH SALT CONCENTRATIONS ON VARIOUS PHYSIOLOGIC PARAMETERS OF MAIZE ROOTS, (IN GERMAN),
Humboldt-Universitaet zu Berlin (East Germany). Biology Section.
W. Dreier, and H. Goering.
Wiss Z Humboldt-Univ Berl Math Naturwiss Reihe 23(6); p 641-644, 1974.

Descriptors: *Salts, Corn(Field), *Roots, Plant physiology, Salt tolerance.

Reduction of water potential by physiologically high concentrations of salt or osmotica results in an increase of endogenous osmotic potential of the root cells (Zea Mays.). This increase is due to increased ion concentration, whereas the sugar concentration decreases. Long-distance transport of assimilate is impeded by a long term incubation of the roots in salt water.—Copyright 1975, Biological Abstracts, Inc.
W76-06790

3D. Conservation In Domestic and Municipal Use

A MARGINAL COST BASIS FOR METROPOLITAN WATER SUPPLY ALLOCATION AND OPERATION,
Northwestern Univ., Evanston, Ill. Dept. of Civil Engineering.
For primary bibliographic entry see Field 6A.
W76-06164

WASTEWATER FLOW REDUCTION IN THE HOME,
Enviro Control, Inc., Rockville, Md.
A. Hershaft.
Journal Environmental Systems, Vol. 4, No. 3, p 217-239, Fall 1974. 3 fig, 5 tab, 51 ref.

Descriptors: *Water pollution control, *Water conservation, *Water utilization, *Recycling, Water allocation(Policy), Water supply, Water policy, Reclaimed water.
Identifiers: Household water use, Waste water flow reduction.

Of the average per capita water demand of 150 gallons per day in the US, 60 gallons are used for residential purposes, 50 in industry, 20 in commercial applications, 10 for public purposes and 10 unaccounted, not including irrigation and outdoor recreation. In order to meet the zero discharge goal of the Federal Water Pollution Act of 1972 residential water use is a prime target for conservation measures. Studies indicate that household water use can be reduced by 35% with available technology and that there is general public acceptance of devices. There are many inexpensive flow reduction devices usable on toilets. Another approach is in-house recycling of used water for a less exacting use on the theory that water quality need only be sufficient for the intended purpose. For example, laundry wastewater can be used for flushing toilets and watering lawns with some treatment for foam, suspended solids and other contaminants. Many suggestions for saving water, including ponding water for general cleaning rather than letting the spigot run, sharing a bath or shower with another family member, lowering the water level in the toilet tank by adjusting the float, etc. Education is the key to effecting savings and demonstration programs in particular are useful. Principal benefits are decreased demand for water treatment, wastewater treatment, sewer capacity, and energy generation. Costs incurred are in promotion, acquisition, installation, and operation of equipment. There may also be some loss of conveniences and freedom of action. Despite general public acceptance of water conservation in concept, there needs to be strong incentive on the part of government to overcome resistance to actually installing and using devices to reduce water use. (Smith - North Carolina)
W76-06280

WATER-SAVING DEVICES: THE STATE OF THE ART,
Pennsylvania State Univ., University Park. School of Forest Resources.
W. E. Sharpe, and P. W. Fletcher.
DE/Journal, p 11-13, 15, October, 1975. 2 fig, 5 ref.

Descriptors: *Water conservation, Energy, Costs, Sewage, Water utilization, Efficiencies, Wastes, Reviews.
Identifiers: *Water saving devices, Energy consumption, Water heating, Waste flow.

Predictions of water needs are in need of revision because of the change in the country's energy needs. Water conservation must be practiced to alleviate this problem as well as the unnecessary treatment of large amounts of waste. Methods of water conservation, such as new pricing, universal metering, and public education, are generally only temporary solutions. Water saving devices can accomplish the same goals cheaply and without major disruptions in water use habits. The impact and cost effectiveness of various water saving devices are discussed. Studies have shown that water use reductions on the order of 20% resulted when devices were installed on resident owned dwellings. Reductions were insignificant where tenant landlord situations prevailed and in commercial establishments. Waste flow reduction efforts on infiltration-inflow correction can account for more than 30 to 40% of the sewage flow reaching the treatment plant. For on-lot sewage disposal systems, water saving devices can produce a 40%

reduction in sewage flows. A 26% reduction was found when a waste water recycling system was used with septic tanks. A study showed that an estimated 560,000 barrels of oil could be saved daily with the efficient use of hot water. The increased concentrations of solids that would result from waste flow reductions could have an adverse effect on sewage systems that are designed to carry small loads, but generally this problem is thought to be insignificant. Studies have shown that water saving devices such as shower flow controls, and toilet inserts are cost effective on new and old homes. A limitation is their availability. (Pinto-FIRL)
W76-06317

REGIONAL WASTE WATER DEVELOPMENT PLAN: ANALYSIS OF EXISTING FACILITIES.
Alamo Area Council of Governments, San Antonio, Tex.
For primary bibliographic entry see Field 5D.
W76-06351

REORIENTATION OF URBAN WATER RESOURCES RESEARCH, FINAL REPORT,
Rutger-The State Univ., New Brunswick, N.J. Water Resources Research Inst.
For primary bibliographic entry see Field 6B.
W76-06553

REORIENTATION OF URBAN WATER RESOURCES RESEARCH, EXECUTIVE SUMMARY,
Rutger-The State Univ., New Brunswick, N.J. Water Resources Research Inst.
For primary bibliographic entry see Field 6B.
W76-06554

ANNUAL REPORT 1974.
Lehigh-Northampton Counties Joint Planning Commission, Lehigh Valley, Pa.
For primary bibliographic entry see Field 6B.
W76-06572

ENVIRONMENTAL MANAGEMENT FOR THE METROPOLITAN AREA CEDAR-GREEN RIVER BASINS, WASHINGTON, PART II: URBAN DRAINAGE.
Army Engineer District, Seattle, Wash.
For primary bibliographic entry see Field 6G.
W76-06573

ESTIMATING INDIRECT COST OF URBAN WATER USE,
Koebig and Koebig, Inc., Los Angeles, Calif.
For primary bibliographic entry see Field 6C.
W76-06615

METER REPLACEMENT PROGRAM PAYS FOR ITSELF,
Mankato Water and Sanitation Dept., Minn.
For primary bibliographic entry see Field 6C.
W76-06630

3E. Conservation In Industry

ENERGY AND POLLUTION CONCERNS IN DREDGING,
Army Engineer Div. South Atlantic, Atlanta, Ga.
For primary bibliographic entry see Field 5C.
W76-06183

UTILIZATION OF ANIMAL MANURES AND SEWAGE SLUDGES IN FOOD AND FIBER PRODUCTION,
Iowa State Univ. of Science and Technology, Ames. Council for Agricultural Science.
For primary bibliographic entry see Field 5D.
W76-06198

Field 3—WATER SUPPLY AUGMENTATION AND CONSERVATION

Group 3E—Conservation In Industry

BIBLIOGRAPHY OF STUDIES ON THE DENSITY AND OTHER VOLUMETRIC PROPERTIES FOR MAJOR COMPONENTS IN GEOTHERMAL WATERS, 1928-1974.
Geological Survey, Menlo Park, Calif.
For primary bibliographic entry see Field 4B.
W76-06454

AQUEOUS SOLUBILITY OF PETROLEUM AS APPLIED TO ITS ORIGIN AND PRIMARY MIGRATION.
Geological Survey, Denver, Colo. Office of Energy Resources.
For primary bibliographic entry see Field 4B.
W76-06455

PROCESS OF REMOVING AMMONIACAL NITROGEN FROM WASTE WATER.
Iwao Engineering Co., Inc., Tokyo (Japan). (Assignee).
For primary bibliographic entry see Field 5D.
W76-06463

GEOTHERMAL POWER SYSTEM AND METHOD.
J. S. Swearingen.
U.S. Patent No. 3,935,102, 5 p, 3 fig, 8 ref; Official Gazette of the United States Patent Office, Vol 942, No 4, p 1873-1874, January 27, 1976.

Descriptors: *Patents, *Geothermal studies, *Heat flow, *Thermal conductivity, *Thermal water, Temperature, Scaling, Heat transfer, Porous media, Gravels, Heat exchangers, Water reuse.

A heat transfer medium in the form of a housing containing porous material such as a bed of gravel or other granular material is used to transfer heat from the unrefined water to clean water which is then passed through the heat exchanger. The hot unrefined water does not come in contact with the heat exchanger thus avoiding the problem of scaling or corrosion on the surfaces of the heat exchanger. In the system a volume of the hot unrefined water is passed through a housing containing porous material which pick up the heat of the water. A volume of clean water is then passed through the housing to pick up the heat from the porous material. The now heated clean water can then be passed through a heat exchanger without significant danger to the surfaces of the exchanger. The clean water can be recycled through the system many times, each time passing through the housing immediately after a volume of the unrefined water. The source of the clean water may be the unrefined water which has been passed through the porous material. After being removed from the housing, the cooled unrefined water is delivered to a detention receptacle. Here it attains stabilization through elimination of its supersaturation and many of the impurities precipitate to the bottom of the receptacle. The liquid which is left on the top of the receptacle is substantially free of impurities to the extent that what impurities are left in the liquid are not sufficient to unduly damage the surfaces of the heat exchanger. (Sinha-OEIS)
W76-06472

STRAINING APPARATUS.
AB Cellico, Tumba (Sweden). (Assignee).
L. G. Rundqvist, and K. F. Jakobson.
U.S. Patent No. 3,935,109, 3 p, 2 fig, 10 ref; Official Gazette of the United States Patent Office, Vol 942, No 4, p 1877, January 27, 1976.

Descriptors: *Patents, *Waste water treatment, *Industrial wastes, *Recycling, *Filtration, *Pulp and paper industry, *Pulp wastes, Fibers(Plant), Water reuse, Recirculated water, *Separation techniques, Filters.
Identifiers: Strainers(Filters).

A straining apparatus separates the fibers from the backwater coming from a paper making machine so that the water can be re-used as spray-water. The apparatus consists of a funnel-shaped vessel with an outlet. A first strainer forms one wall of the vessel. Fiber containing liquid is sprayed on the outside of the strainer wall. A second strainer having a smaller total area covers the outlet of the vessel and is situated lower than the first strainer wall. During operation a liquid column is maintained on the inlet side of the second strainer and a free liquid surface is formed between the two strainers. The mesh openings of the second strainer are larger than the mesh openings of the first strainer but small enough so that any fibers passing through the first strainer due to rupture will obstruct the second strainer. (Sinha-OEIS)
W76-06476

METHOD FOR DETERMINING AND CONTROLLING LIQUID COOLING SYSTEM CHARACTERISTICS.
Brown and Root, Inc., Houston, Tex. (Assignee).
For primary bibliographic entry see Field 5G.
W76-06484

EFFLUENT GUIDELINES -- STEAM ELECTRIC POWER GENERATING POINT SOURCE CATEGORY.
Environmental Protection Agency, Washington, D. C.
For primary bibliographic entry see Field 5G.
W76-06513

TIRE AND SYNTHETIC SEGMENT OF THE RUBBER PROCESSING POINT SOURCE CATEGORY.
Environmental Protection Agency, Washington, D. C.
For primary bibliographic entry see Field 5G.
W76-06516

EFFLUENT GUIDELINES AND STANDARDS - FERROALLOYS MANUFACTURING POINT SOURCE CATEGORY.
Environmental Protection Agency, Washington, D. C.
For primary bibliographic entry see Field 5G.
W76-06518

FERROALLOY MANUFACTURING POINT SOURCE CATEGORY.
Environmental Protection Agency, Washington, D. C.
For primary bibliographic entry see Field 5G.
W76-06519

EFFLUENT LIMITATIONS AND GUIDELINES - PRINTING INK FORMULATING POINT SOURCE CATEGORY.
Environmental Protection Agency, Washington, D. C.
For primary bibliographic entry see Field 5G.
W76-06520

NONFERROUS METALS MANUFACTURING POINT SOURCE CATEGORY.
Environmental Protection Agency, Washington, D. C.
For primary bibliographic entry see Field 5G.
W76-06521

SOLAR ENERGY TECHNOLOGY, STATE OF THE ART, AN ANNOTATED BIBLIOGRAPHY.
Ocean Engineering Information Service, La Jolla, Calif., Energy Resources Div.
For primary bibliographic entry see Field 3A.
W76-06565

NORTHERN GREAT PLAINS RESOURCE PROGRAM, WATER WORK GROUP REPORT.
Northern Great Plains Resources Program, Denver, Colo.
Available from the National Technical Information Service, Springfield, Va 22161 as PB-243 150, \$10.00 in paper copy, \$2.25 in microfiche. Reports No. NGPRP/CD-74-200, NGPRP/CD-74-201, NGPRP/CD-74-202, NGPRP/CD-74-203, December 1974, 333 p, 19 fig., 83 tab., 4 append.

Descriptors: *Water resources, *Great Plains, *Water resources development, *Industrial water, Montana, North Dakota, South Dakota, Wyoming, Nebraska, Institutional constraints, Fossil fuels, Water utilization, Surface waters, Groundwater, Interstate compacts, Water rights, Water supply, Streamflow, Recreation, Wild rivers, Alternative planning, Competing uses, Indian reservations, Beneficial use, Strip mines, Consumptive use, Water costs.
Identifiers: *Northern Great Plains, *Coal gasification, Water pollution potential.

The surface water of the Upper Missouri River Main Stem and the Yellowstone Basins, and the groundwater resources in Montana and Wyoming, are analyzed in relation to the development of coal resources. The constraints to water resources development are discussed with particular reference to state water laws, policies, administration, and interstate compacts. Also considered are federal constitutional and statutory provisions, and Indian water rights. The potential for water resources development is based on availability and uses by coal-fired powerplants and coal gasification plants. Alternative plans for water supply for coal development are projected at a base level, most probable level, and extensive level, and include considerations of availability and cost of groundwater. Impacts of water use for coal development at the projected levels as related to reservoir operation, streamflow, navigation, recreation, fisheries, and water quality are evaluated as are the effects of strip mining on groundwater. The costs of storage and water transmission facilities are estimated for powerplants and gasification plants in North Dakota, Montana, and Wyoming. The recreation and aesthetic value of the rivers in the region are described and what constraints should be imposed on the existing and proposed mineral and industrial development in order to maintain their quality are detailed. (Auen-Wisconsin).
W76-06616

AN ECONOMIC ANALYSIS OF GEORGIA'S MARINE CHARTER BOAT FISHING INDUSTRY.
Georgia Univ., Athens. Dept. of Agricultural Economics.
For primary bibliographic entry see Field 6C.
W76-06624

ECONOMIC ANALYSIS OF EFFLUENT GUIDELINES FOR THE ASBESTOS INDUSTRY.
Little (Arthur D.), Inc., Cambridge, Mass.
For primary bibliographic entry see Field 5G.
W76-06626

YBBARPSAN-A SMALL RECEPTACLE FOR A LARGE INDUSTRY: WATER CONSERVATION ACTION IN THE VICINITY OF PERSTORP AB, (IN SWEDISH).
For primary bibliographic entry see Field 5D.
W76-06732

3F. Conservation In Agriculture

SOCIOECONOMIC ANALYSIS OF A MAJOR REHABILITATION OF IRRIGATION AND

WATER MANAGEMENT SYSTEMS IN EASTERN IDAHO.

Idaho Univ., Moscow. Dept. of Agricultural Engineering.
J. R. Busch, K. H. Lindeborg, G. D. Galinato, J. E. Milliner, and M. B. Ali.
Available from the National Technical Information Service, Springfield, Va. 22161, as PB-251 544, \$4.00 in paper copy, \$2.25 in microfiche.
Idaho Water Resources Research Institute, Moscow, Completion Report, June 1975. 31 p, 3 fig, 19 tab, 5 ref. OWRT B-028-IDA(4) B-033-IDA(5). 14-31-0001-3878, 14-01-0001-4077.

Descriptors: *Irrigation Practices, Distribution Systems, Sprinkler Irrigation, Furrow Irrigation, Border Irrigation, *Irrigation Efficiency, Economics, *Replacement Costs, Irrigation districts, *Idaho, *Water management (Applied), *Rehabilitation.
Identifiers: Jefferson County (Idaho), North Rigby Irrigation District (Idaho), Snake River Fan (Idaho).

High water tables caused by overuse of irrigation water have created physical and socioeconomic problems in some areas of southeastern Idaho. In one area, the Snake River Fan of Jefferson County, the irrigation systems and management practices were investigated to determine their contribution to the high water table problem. The investigations showed that the present systems are quite inefficient due to soils with high water intake rates, long irrigation runs and duplication of many irrigation canals. Engineering and economic analyses were made to determine the least cost method of rehabilitating the present system and to determine the capability of the area to support various rehabilitation schemes. Both analyses utilized linear programming models to determine optimum solutions subject to various social and legal constraints. The results obtained indicate that present practices are the most economical for the present cost and availability of water. Wells equipped with high head pumps supplying sprinkler systems appear to be the best alternative if a marked increase in overall irrigation efficiency is to be achieved. Farm sizes of 160 acres or more would be necessary to produce enough net income to support any major rehabilitation scheme.
W76-06161

INSTITUTIONAL RATIONING OF CANAL WATER IN NORTHERN INDIA: CONFLICT BETWEEN TRADITIONAL PATTERNS AND MODERN NEEDS.

California Univ., Davis. Dept. of Agricultural Economics; and California Univ., Davis. Dept. of Water Science and Engineering.
For primary bibliographic entry see Field 6D.
W76-06235

EFFECTS OF FERTILIZATION AND IRRIGATION ON YIELD AND POTASSIUM CONTENT OF ALFALFA AND ON AVAILABLE SOIL POTASSIUM.

Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Agronomy.
G. D. Jones, J. A. Lutz, Jr., and E. B. Hale.
Commun Soil Sci Plant Anal. 5(3): 155-163. Illus. 1974. (In Engl. with Engl. summ.).

Descriptors: *Alfalfa, *Fertilization, *Effects, *Nutrient requirements, *Irrigation effects, *Plant growth, *Potassium, Soil chemistry, Crop production, Crops, Field crops.
Identifiers: Medicago-Sativa.

Alfalfa (*Medicago sativa*) yields were determined for 5 yr on Davidson clay loam at Orange, Virginia. The effects of irrigation and K application on the yield and chemical composition of alfalfa and on the available soil K content were determined. Seven rates of K were applied annually. The available K content of the 0-15 cm soil depth gradually decreased on irrigated and non-irrigated

plots when 0, 93 and 186 kg K/ha were applied. Available soil K increased over 100% when 556 kg K/ha was applied. Possibly because of leaching, the decrease in available soil K in the 0-15-cm depth of plots treated with 0 and 93 kg K/ha was slightly greater on irrigated than on non-irrigated plots. Where K was applied, considerably more available K was presented in 1973 in the profile of irrigated plots than in non-irrigated plots. The K concentration of the alfalfa was unaffected by irrigation but was increased with added K during the last 3 yr. Alfalfa yields were increased each year with irrigation but there was no response to K fertilization.—Copyright 1975, Biological Abstracts, Inc.
W76-06243

DROUGHT AND AGRICULTURE, World Meteorological Organization, Geneva. (Switzerland). For primary bibliographic entry see Field 2B. W76-06265**EFFECTS OF WATER STRESS ON LEAF RESPIRATION, TRANSPIRATION RATES IN THE DARK AND CUTICULAR RESISTANCE TO WATER VAPOR DIFFUSION OF TWO CORN INBREDS.**

Laval Univ., Dept. of Phytotechnie, Quebec.
For primary bibliographic entry see Field 2D.
W76-06266

SALINITY-OZONE INTERACTIVE EFFECTS ON ALFALFA YIELD AND WATER RELATIONS.

Agricultural Research Service, Riverside, Calif. Salinity Lab.
For primary bibliographic entry see Field 3C.
W76-06269

EFFECT OF IRRIGATION REGIMES IN RELATION TO CHLOROCHOLINE CHLORIDE (CCC) APPLICATION ON WHEAT.

Cairo Univ., Giza (Egypt). Dept. of Agronomy; and Cairo Univ., Giza (Egypt). Faculty of Agriculture.
A. H. El-Hattab, and A. F. Ibrahim.
Z Acker-Pflanzenbau. 139(1), p 71-81, 1974.

Descriptors: *Irrigation practices, *Wheat, Chlorides, Spraying, Crop production, Crop response, Fertilizers.
Identifiers: *Chlorocholine chloride, Spikes.

The application of irrigation regimes (number and time), CCC spraying at different growth stages of wheat cultivar 'Giza 155,' and their interaction under 60 kg N/feidan was investigated in both 1971 and 1972 seasons. Increasing the number of waterings (6 times) induced elongation of plant height, leading to lodging of wheat plants compared to 3 and 4 irrigations. Number of tillers and spikes per plant were not generally affected by the various irrigation regimes. The total yield, straw and grain was rather high under 6 waterings in both seasons. However, the grain yield under 3 times of irrigation in 1972 showed an obvious increase over the other 2 regimes. With regard to CCC-treatments, a reduction in stem height was observed when CCC was sprayed either at the 8-leaf stage or after primordial initiation in 1972 season. In addition, an obvious increase in grain yield was obtained in 1972 under all CCC-times of application, particularly when it was applied after primordial initiation. Concerning the interaction between watering regimes and CCC-time of application, CCC generally reduced stem height especially under average moisture conditions when it was sprayed after primordial initiation. Accordingly, an increase in lodging resistance of the CCC-treated plants under all water regimes was recorded. Moreover, grain yield increased when CCC was sprayed after primordial initiation under water stress. This increase was linked by an in-

crease in number of tillers and spikes per plant, 1000 grain weight and the degree of lodging resistance.—Copyright 1974, Biological Abstracts, Inc.
W76-06279

WATER USE, ENERGY BALANCE AND GROWTH OF MAIZE AT SAMARU, NORTHERN NIGERIA.

Institute for Agricultural Research, Zaria (Nigeria).
J. M. Kowal, and A. H. Kassam.
Agric Meteorol. 12(3), p 391-406, 1973.

Descriptors: *Water utilization, *Energy, *Corn (Field), Africa, Growth rates, Transpiration, Soils, Crop production, Climates.
Identifiers: *Nigeria, Samaru.

Energy and water budget of maize crop grown in a dry sub-humid climate of northern Nigeria were assessed and related to crop performance. The pattern of crop water requirement during the growing season was well matched to the pattern of crop water availability. The period of maximum water requirement by the crop occurred when the leaf area index was greater than 2.1 and coincided with the period when the amount and frequency of rainfall was greatest. However, under the prevailing climatic conditions, with potential evapotranspiration rates of 4-6 mm per day, the crop may experience water stress, if there is no rain for a period of 5 days or more. The rate of crop growth was drastically reduced when soil-water potential decreased below -0.5 bar. The total water used by the crop during 117 days from sowing to harvest was 486 mm, of which 345 mm transpired through the plants. Crop water use efficiency was 353 g of water per g of dry matter. The crop yielded 7284 kg ha⁻¹ of grain and 19,180 kg ha⁻¹ of total dry matter. The efficiency of energy conversion for the season was 1.4% of the total incident radiation, while during the period of active growth the energy conversion was 2.4%.—Copyright 1974, Biological Abstracts, Inc.
W76-06298

SEEDBED SOIL SALINITY AND EMERGENCE OF PEPPERS AND CARROTS UNDER SPRINKLER AND FURROW IRRIGATION.

Agricultural Research Service, Weslaco, Tex.
For primary bibliographic entry see Field 3C.
W76-06305

EFFECTS OF NITROGEN, POTASSIUM AND IRRIGATION ON YIELD AND QUALITY OF LEMON.

Agricultural Research and Education Center, Lake Alfred, Fla.
R. C. J. Koo, T. W. Young, R. L. Reese, and J. W. Kesterson.
J Am Soc Horti Sci. 99(4), p 289-291, 1974.

Descriptors: *Nitrogen, *Potassium, Irrigation practices, Citrus fruits, *Lemons, Crop production.

Yields and quality were compared on young bearing 'Bearss' lemon (*Citrus limon* L.) trees grown with 3 rates of N and K and 2 levels of soil moisture over a 4-yr period. Increased rates of N application increased fruit production, incidence of fruit with scab, and green fruit; and decreased acid content of juice. K applications increased the acid content of juice. Irrigation increased fruit size and decreased the number of green fruit after curing. A leaf N content of 2.2-2.6% is suggested for optimum fruit production for 'Bearss' lemon under Florida conditions.—Copyright 1974, Biological Abstracts, Inc.
W76-06314

Field 3—WATER SUPPLY AUGMENTATION AND CONSERVATION

Group 3F—Conservation In Agriculture

CHANGES IN CLIMATE AND ESTIMATED EVAPORATION ACROSS A LARGE IRRIGATED AREA IN IDAHO.
Wyoming Univ., Laramie. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 2D.
W76-06406

CASE STUDY: FOR THE ANALYSIS OF WATER MANAGEMENT INVESTMENTS ON HAND OF THE EXAMPLE OF THE KISKORE RIVER BARRAGE AND ITS IRRIGATION SYSTEMS.
For primary bibliographic entry see Field 4A.
W76-06427

ANTI-RUN AHEAD SYSTEM FOR TRAVELING HOSE PULL SPRINKLERS.
Heinzman Engineering, Inc., Grand Island, Nebr. (Assignee).
J. C. Groelz, and J. W. Heinzman.
U.S. Patent No. 3,934,819, 4 p, 4 fig, 4 ref; Official Gazette of the United States Patent Office, Vol 942, No. 4, p 1788, January 27, 1976.

Descriptors: *Patents, *Irrigation, *Sprinkler irrigation, *Irrigation systems, *Irrigation practices, Lateral conveyance structures, Application equipment.
Identifiers: Mobile irrigation devices, Brakes.

Some mobile irrigation devices utilize large capacity high pressure irrigation guns which oscillate and are rearwardly directed and at the start of a run of the mobile irrigation device along a field the reactionary forces applied to the sprinkler as a result of the rearward discharge of irrigation water tends to overcome rolling resistance of the wheels and the frictional drag of the initial short length of hose being dragged behind the irrigation device with the result that the device tends to move along the field at a rate faster than that which would be determined by the cable being wound on the winch. The mobile irrigation device of this invention is equipped with a chain drive for driving the winding drum for the cable along which the irrigation device pulls itself. The wheels of the device are provided with fluid pressure actuated brakes and tension sensing structure is provided for sensing the taut reach of the driving chain and connected to a control valve interposed in a high pressure fluid line extending from the high pressure irrigation water supply to the brake actuator. Thus, should the tension of the taut reach of the driving chain be reduced below a predetermined minimum the brakes of the mobile irrigation device are applied to prevent a 'run ahead' condition. (Sinha - OEIS)
W76-06465

SPRINKLER CONTROL.
Telsco Industries, Dallas, Tex. (Assignee).
C. W. Phaup.
U.S. Patent No. 3,934,820, 8 p, 7 fig, 10 ref; Official Gazette of the United States Patent Office, Vol 942, No. 4, p 1788, January 27, 1976.

Descriptors: *Patents, *Irrigation, *Sprinkler irrigation, *Irrigation systems, *Irrigation efficiency, *Irrigation practices, Application equipment.
Identifiers: Pop-up sprinklers.

A pop-up sprinkler system protected from accumulation of debris, from interference with adjustable controls, and from operational difficulties caused by complicated mechanisms and unregulated pressure heads is described. The invention comprises an outer housing, a rotatable nozzle head vertically movable through an outer housing cover, and an inner housing attached to the nozzle head and slidably received within the outer housing. Enclosed within the inner housing is an impeller driven transmission with a speed-reducing gear train isolated from the flow of water, a manually adjustable by-pass throttle to control the

flow velocity of water driving a water-wheel impeller, and an accurate and greatly simplified direction controlling mechanism to control the location and size of an arc sector over which water is to be discharged. As the inner housing is accessible only when the sprinkler head is inoperative and the outer housing cover has been removed, problems associated with easily accessible adjustment controls are minimized. Under the pressure of water applied to an outer housing water inlet, the nozzle head and inner housing overcome the compressive force of a spring to assume a fully extended position in sealing contact with the outer housing. The flow of water between the water inlet and a drive tube attached to the nozzle head is essentially restriction free to minimize pressure drop across the transmission. (Sinha - OEIS)
W76-06466

IRRIGATION SYSTEM WATER EMITTER.
D. Fitzhugh.
U.S. Patent No. 3,934,824, 4 p, 2 fig, 7 ref; Official Gazette of the United States Patent Office, Vol 942, No. 4, p 1789, January 27, 1976.

Descriptors: *Patents, *Irrigation, *Irrigation systems, *Irrigation efficiency, Irrigation practices, Application equipment, Distribution systems, Water distribution (Applied).
Identifiers: Drip irrigation, Water emitters.

A water emitter is provided for drip irrigation systems which can be modified at the irrigation site to accommodate variations in pressure in differing areas in the specific configuration or layout of system used, and the topography of the land to be irrigated. The emitter includes a flexible, collapsible thermoplastic or elastomeric emitter tube, having a number of spaced-apart crimps. The crimps serve to close the emitter tube when no water is supplied, and to provide a sinuous path for water, thus increasing friction and controlling pressure at each emitter in the system. The length of each emitter and, therefore, the number of crimps can be selected according to the desired pressure at each emitter site along the system. Also included with each emitter is an elongated, relatively rigid protective tube to prevent soil compaction of the emitter in its collapsed non-functioning state. (Sinha - OEIS)
W76-06468

THE EFFICIENT USE OF UTAH'S IRRIGATION WATER: INCREASED TRANSFERABILITY OF WATER RIGHTS.
Utah Univ., Salt Lake City. Coll. of Law.
M. H. Anderson.
Utah Law Review, Vol. 1975, p. 158-78 Spring 1975. 21 p, 1 dwg.

Descriptors: *Water rights, *Water resources development, *Utah, *Irrigation efficiency, Irrigation practices, *Irrigation programs, Irrigation operation and maintenance, Irrigation engineering, Irrigation design, Irrigated land, Irrigable land, Irrigation districts, Water control, Water districts, Water delivery, Water distribution (Applied), Water allocation (Policy), Water conservation, Water users, Water yield improvement.
Identifiers: *Mutual water companies.

Utah's economic well-being depends upon the adequacy of its water supply. It is essential that existing water supplies be used as efficiently as possible. Irrigation water is almost entirely distributed through organized irrigation entities such as mutual water companies, in which shareholders receive proportionate shares of the corporation's water supply in lieu of dividends, and public agencies, where distribution is either by state irrigation and water conservancy districts or by federal Bureau of Reclamation contracts. Increased efficiency in water use can be achieved through changes in water resource allocation arising through alteration of existing laws and practices. Enhancing the marketability of irrigation water through suggested

changes could provide the needed efficiency. Suggested changes include: (1) state encouragement of mutual water companies; (2) state legislation awarding compensation to water users injured by a proposed water transfer; (3) abolition of mutual water companies' restrictions upon transferability of water among shareholders; and (4) abolition of the required Bureau of Reclamation's consent to a water transfer when repayment of federal loans have been previously arranged. (Welch-Florida)
W76-06487

ACROLEIN RESIDUES IN IRRIGATION WATER AND EFFECTS ON RAINBOW TROUT.
Bureau of Reclamation, Denver, Colo. Engineering and Research Center.
For primary bibliographic entry see Field 5C.
W76-06563

DRAINAGE AND RECLAMATION PERFORMANCE AT THE IMAM EXPERIMENTAL FIELD IN THE GREATER MUSSAYEB PROJECT, A MONITORING STUDY.
Institute for Applied Research on Natural Resources, Baghdad (Iraq).
For primary bibliographic entry see Field 3C.
W76-06581

COSTS ARE SOARING: IRRIGATING FROM THE UNDERGROUND.
Arizona Univ. Tucson. Dept. of Agricultural Economics.
G. S. Willett, and S. Hathorn Jr.
Progressive Agriculture in Arizona, Vol. 27, No. 5, p 1-5, September-October, 1975. 2 tab.

Descriptors: *Arizona, *Pumping, *Irrigation practices, *Electric power costs, *Economic impact, Groundwater mining, *Water costs, Irrigation, Costs, Crop production, Agriculture, Farm prices.

Arizona is the only state that relies totally on irrigation for crop production. Groundwater is used for 52 percent of all harvested cropland in Arizona, and water pumps for irrigation use 13.2 percent of the energy used by agriculture in the state. Depending on the crop grown, as of 1975 energy cost accounts for 18 to 32 percent of the total costs of producing major central Arizona field crops. As pumping costs rise, there will be a drastic change in the method and type of crop production. Improved and efficient irrigation will be more widely practiced and higher value crops will be grown. As it costs more to pump, land value will fall, the number of farm failures will increase, and the trend toward larger and fewer farms will continue. (Robinet-Arizona)
W76-06586

THE ECONOMICS OF CONVERTING NATURAL GAS-POWERED IRRIGATION PUMPS TO ALTERNATE ENERGY SOURCES IN SOUTHEASTERN ARIZONA.
Arizona Univ., Tucson. Dept. of Agricultural Economics.
G. S. Willett, S. Hathorn Jr., C. E. Robertson, and C. G. Page.
Report No. 5, May, 1975. 55 p, 2 fig, 27 tab, 14 ref.

Descriptors: *Economic impact, *Natural gas, *Irrigation, *Alternative costs, *Pumping, *Electric power costs, Water costs, Costs, Construction costs, *Arizona, Irrigation, Groundwater mining, Pumps, Farm prices.
Identifiers: Cochise County (Ariz).

According to current estimates approximately 2,181 pumps in Arizona utilize natural gas engines, representing about 30 percent of the irrigation power units in the state. Use of natural gas for irrigation is particularly important in Cochise County where 1,256 pumps use this fuel. Converting an existing natural gas power plant to electricity will

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require an investment between \$10,408 and \$15,627 and conversion to diesel will cost between \$14,333 and \$15,520. In terms of added pumping costs, conversion from natural gas to electricity will add \$11.50 to \$15.50 to the total cost of pumping an acre-foot of water, and conversion to diesel will add an additional \$11.71 to \$14.99 per acre-foot. (Robinet-Arizona)
W76-06588

THE RATIONALE OF NOMAD ECONOMY,
Uppsala Univ. (Sweden).
For primary bibliographic entry see Field 4C.
W76-06591

DESERTIFICATION: A WORLD PROBLEM,
Worldwatch Inst., Washington, D.C.
For primary bibliographic entry see Field 4C.
W76-06592

CORRECTIVE TAXES FOR POLLUTION CONTROL: AN APPLICATION OF THE ENVIRONMENTAL PRICING AND STANDARDS SYSTEMS TO AGRICULTURE,
California Univ., Santa Cruz. Dept. of Economics.
For primary bibliographic entry see Field 5G.
W76-06618

A SOCIO-ECONOMIC EVALUATION OF ALTERNATIVE WATER MANAGEMENT POLICIES ON THE RIO GRANDE IN NEW MEXICO,
New Mexico State Univ., University Park. Dept. of Agricultural Economics and Agricultural Business.
For primary bibliographic entry see Field 6B.
W76-06644

LOCALIZATION OF DAMAGE INCURRED DURING WATER IMBIBITION BY PISUM SATIVUM AND ZEA MAYS SEEDS, AS REVEALED BY THE TOPOGRAPHIC TETRAZOLIUM TEST,
Scottish Horticultural Research Inst., Invergowrie.
For primary bibliographic entry see Field 2I.
W76-06649

AGRICULTURAL DROUGHT OF 1972 KHARIF SEASON,
Meteorological Office, Poona (India).
For primary bibliographic entry see Field 2B.
W76-06681

USING EVAPORATION VALUES FROM EVAPORATION PANS TO ESTIMATE THE WATER CONSUMPTION OF AGRICULTURAL PLANTS AS THE BASIS OF SPRINKLER IRRIGATION CONTROL, (IN GERMAN),
For primary bibliographic entry see Field 2D.
W76-06729

EVAPORATIVE COOLING OF 'DELICIOUS' APPLES: THE ECONOMIC FEASIBILITY OF REDUCING ENVIRONMENTAL HEAT STRESS,
North Carolina State Univ., Raleigh. Dept. of Horticultural Science.
C. R. Unrath, and R. E. Sneed.
J Am Soc Hortic Sci. 99(4), p 372-375, 1974.

Descriptors: *Apples, Fruit crops, *Evaporation, Cooling, *Irrigation, Temperature, Feasibility, Economic feasibility, *Thermal stress.
Identifiers: *Evaporative cooling(Fruit).

The response of 'Red Delicious' apples to low volume overtree evaporative cooling (EC) irrigation was studied over a 4-yr period from 1969-72. While the amount of thermal load and irrigation system run-time varied from year to year, EC consistently resulted in fruit temperature averaging

5.6 degrees C (10.1 degrees F) for the entire 509 h the system operated over the 4-year period. In each of the 4 yr, EC improved fruit quality; on the average increasing total reddish color 8%, solid red color 13%, soluble solids 1%, and fruit weight 22-g while reducing corking 8% and bitter pit 7%. The additional fruit coloration stimulated by EC concentration harvest in the earlier portion of the harvest season. During the 4 yr of the experiment, an additional 1/3 of the cooled crop was harvested, with sufficient solid red color to meet 'extra fancy' U.S. grade, during the 1st 2 wk of the seasons. Because of higher early-season prices, the concentrated earlier harvest of EC fruit is of considerable economic benefit. In locations where heat stresses are common, the use of EC and soil irrigation should be economically feasible.--Copyright 1974, Biological Abstracts, Inc.
W76-06791

IRRIGATION OF FIELD TOMATOES AND MEASUREMENT OF SOIL WATER CHANGES BY NEUTRON MODERATION METHODS,
California Univ., Riverside. Dept. of Soil Science and Agricultural Engineering.
G. H. Cannell, and C. W. Asbell.
J Am Soc Hortic Sci. 99(4), p 305-308, 1974.

Descriptors: *Irrigation, *Tomatoes, Soil water, Measurement, Soil moisture, Fruit crops, Crop production, Roots.
Identifiers: Lycopersicon-Esculentum, *Neutron moderation methods.

Irrigation studies with processing tomato, *Lycopersicon esculentum*, cv. VF-145-21-4, showed a highly significant yield increase with increased soil moisture. Total number of fruit (fruit set) was not significantly different with irrigation treatments. Yield differences were largely attributed to small ripe and green fruit, unacceptable for processing, that resulted from soil moisture stress in drier treatments. Soil water volume changes between irrigations were measured in the soil profile using neutron moderation equipment. The total volume of water measured during the season was compared to that applied for each irrigation treatment. With exception of the wet treatment in 1971, agreement between comparisons was within plus or minus 3%. Root growth with depth plotted as a function of time (season) was essentially the same for all irrigation treatments.--Copyright 1974, Biological Abstracts, Inc.
W76-06793

FLOODING EFFECTS ON LIGHT REFLECTANCE, TRANSMITTANCE, AND ABSORPTANCE OF COTTON (GOSSYPIMUM HIR-SUTUM) LEAVES,
Agricultural Research Service, Weslaco, Tex.
For primary bibliographic entry see Field 2i.
W76-06794

INFLUENCE OF WATER STRESS AND GROWTH REGULATOR APPLICATIONS ON SUGAR COMPOSITION OF SOYBEAN LEAVES,
Arkansas Univ., Fayetteville. Dept. of Agronomy.
For primary bibliographic entry see Field 2I.
W76-06796

EFFECT OF DIFFERENT FREQUENCIES OF IRRIGATION ON GRANULATION IN SWEET ORANGE (CITRUS SINENSIS OSBECK),
Himachal Pradesh Univ., Haryana (India). Dept. of Horticulture.
R. P. Awasthi, and J. P. Nauriyal.
J Res Punjab Agric Univ. 10(3), p329-330, 1973.

Descriptors: *Irrigation, Asia, *Crops productivity, Citrus, *Oranges.
Identifiers: India.

Studies on the effect of different frequencies of irrigation comprising 7-14-21- and 28-day intervals on granulation were carried out on Mosambi orange at the Regional Fruit Research Station, Abotari (Maia), during 1966 and 1967. Different frequencies of irrigation failed to show any significant differences in the 1st year, but during the 2nd year, irrigation at 14-day interval gave a significantly lower incidence and extent of granulation than other treatments.--Copyright 1974, Biological Abstracts, Inc.
W76-06797

THE EFFECT OF IRRIGATION ON THE LENGTH, WEIGHT AND DIAMETER OF LETTUCE ROOTS,
National Vegetable Research Station, Wellesbourne (England).
H. R. Rowse.
Plant Soil. 40(2), p381-391, 1974.

Descriptors: *Irrigation, *Lettuce, *Growth rates, Growth stages, Roots.

The total fibrous-root length of mature field-grown lettuce protected from rainfall and not irrigated after establishment was less than 75% of that of irrigated plants, although the corresponding root weights were very similar. Non-irrigated plants had thicker roots, less roots near the soil surface, and more at depth, up to the time that the roots started to die, about 2 wk before the lettuce were mature, the variation of root length with depth and time is described by a simple logarithmic expression.--Copyright 1974, Biological Abstracts, Inc.
W76-06798

VARIETAL RESPONSE OF PEAS TO IRRIGATION AND INTERROW SPACING,
Haryana Agricultural Univ., Hissar (India). Dept. of Agronomy.
H. C. Sharma, and K. P. Singh.
Haryana Agric Univ J Res. 3(1), p1-4, 1973.

Descriptors: *Irrigation, *Peas, *Crop response, Crop production.

A field experiment was conducted to study the response of 2 cultivars of pea, 'T 163' and 'T 19', to 2 row spacings, 30 and 45 cm and 4 irrigation treatments, irrigating at pre-flowering stage; at post-flowering stage; at pre- and post-flowering stages and at preflowering, flowering, and post-flowering stages. 'T 163' gave 38% significantly higher yields of grain than 'T 19'. A single irrigation at pre-flowering or post-flowering was sufficient for raising a good pea crop.--Copyright 1974, Biological Abstracts, Inc.
W76-06799

CORRELATION BETWEEN SOWING TIME AND WEATHER FACTORS ON THE INTENSITY OF GROUNDNUT DISEASES,
Agricultural Research Station, Madras (India).
H. D. Lewin, S. Natarajan, and K. Govindarajan.
Indian J Mycol Plant Pathol. 3(1), p26-32, 1973.

Descriptors: *Plant diseases, Crop response, Crop production, Temperature, Weather, Rainfall intensity.
Identifiers: Arachis-Hypogaea, Cercospora-Arachidicola, Cercospora-Personata, *Groundnut diseases.

Early sowings of groundnut (*Arachis hypogaea*) done at 2-4 wk intervals from 7th June to 22nd July recorded significantly less incidence of 'tikka' disease (*Cercospora personata* and *C. arachidicola*) and higher yields. Sowing on 5th Sept. gave the lowest yield and a high incidence of 'tikka'. Both the time of sowing and 'tikka' incidence were negatively correlated with yield. 'Tikka' incidence was positively correlated with rainfall and negatively correlated with temperature.--Copyright 1974, Biological Abstracts, Inc.
W76-06800

Field 3—WATER SUPPLY AUGMENTATION AND CONSERVATION

Group 3F—Conservation In Agriculture

4. WATER QUANTITY MANAGEMENT AND CONTROL

4A. Control Of Water On The Surface

ECONOMIC AND LEGAL ANALYSIS OF ALTERNATIVE FLOOD CONTROL STRATEGIES: PHASE I.
Massachusetts Univ., Amherst. Dept. of Food and Resource Economics.
For primary bibliographic entry see Field 6F.
W76-06159

DRAINAGE RATES FROM A VERTICAL COLUMN.
Colorado State Univ., Fort Collins.
For primary bibliographic entry see Field 2F.
W76-06165

ROLE OF BOGS IN THE FORMATION OF SPRING FLOOD RUNOFF LOSSES IN THE DRAINAGE BASINS OF THE NORTHWESTERN EUROPEAN USSR.
O. I. Krestovskiy, and S. B. Dribizova.
Soviet Hydrology, Selected Papers, No. 1, p 43-51, 1974. 3 fig, 4 tab, 12 ref, 1 append. Translated from Trudy Gosudarstvennogo Gidrologicheskogo Instituta, No. 214, p 257-270, 1974.

Descriptors: *Bogs, *Runoff, *Floodwater, *Europe, Saturated soils, Wetlands, Snowmelt, Water storage, Soils.
Identifiers: *USSR, *Spring flood runoff.

The storage capacity of bogs and waterlogged depressions and the dynamics of their storage fluctuations were investigated, and the meltwater losses resulting from the filling of the bogs in spring were determined for the drainage basins of the northwestern European USSR. The amount of water stored in bogs on the date of the end of each spring flood is almost equal to the long-period mean value. There are virtually no spring water losses due to the filling of bogs and only in some years do they reach 10-15 mm with respect to a 20% waterlogged drainage basin. The water absorption capacity of bogs and waterlogged depressions (moisture deficit) is about 100 mm. The moisture deficit in bogs is determined in relation to the long-period mean bog storage on the date of the end of intense spring flood runoff. The value of the moisture deficit is used to compute the possible flood water losses associated with the filling of the bogs. The fluctuations in bog storage are close in magnitude to and synchronous with the fluctuations of the moisture content in the upper 50 cm of the soil. Therefore, in the absence of observations of water levels in bogs, the fluctuations in their storage can be taken into account on the basis of soil moisture observations. (Sims-ISIS)
W76-06175

SOME CHARACTERISTICS OF THE PROCESS OF INCOMPLETE MEANDERING OF THE CHANNEL OF THE UPPER OB' RIVER.
N. M. Kulemina.
Soviet Hydrology, Selected Papers, No. 6, p 518-534, 1973. 3 fig, 5 tab, 7 ref. Translated from Trudy Gosudarstvennogo Gidrologicheskogo Instituta, No. 209, p 4-24, 1973.

Descriptors: *Meanders, *Geomorphology, *Rivers, Erosion, Banks, Braiding, Channels, Flood plains, Stream erosion, Cutoffs, Hydroelectric plants, Bridges, Sedimentation, sediments.
Identifiers: *Ob' River(USSR), *USSR.

An investigation in a reach of the Upper Ob' River of channel and floodplain formation, based on the hydromorphological theory of the channel process, revealed some new patterns of incomplete meandering. The reach with incomplete meandering, i.e., a channel process typical of rivers with severely flooded and relatively easily eroded flood plains, is about 300 km long, starting 60 km upstream of Barnaul city and ending at Kamen'-na-Obi city, where the valley is confined by the outliers of the Salair Ridge. Another type of channel process, the midstream bar or channel braiding process, which gradually changes to incomplete meandering, is developed over a 200-km stretch upstream of the foregoing reach. Groups of meanders with a high degree of development are straightened by a shorter cutoff, whose development is accompanied by an increase in the rates of meandering and by the lengthening of the channel downstream of it. Therefore, 50-60 years later, the decrease in the length and degree of development of meanders in the reach with the cutoff are compensated by the lengthening and an increase in the development of meanders downstream of it. In this case, meanders develop particularly rapidly in the downstream part of the straightening cutoff, where the highest rates of bank movement reach 100 m/yr. (Sims-ISIS)
W76-06178

LEVEL OF CLOSED BODIES OF WATER AS ONE OF THE CRITERIA OF GLOBAL WATER EXCHANGE.
Akademiya Nauk SSSR, Moscow. Institut Vodnykh Problem.
For primary bibliographic entry see Field 2A.
W76-06179

OPTIMUM DREDGED DEPTH IN INLAND WATERWAY.
CACI, Inc., Arlington, Va.
For primary bibliographic entry see Field 2J.
W76-06182

WATER AS A FOREST PRODUCT.
New Zealand Parks and Reserves, New Plymouth.
A. D. Jellyman.
N Z J For. 18(2), p 211-216, 1973.

Descriptors: Water, Forests, *Forest management, *Land management, Land use, *Water resources, *Water management(Applied).

Land management is a crucial factor in preserving water resources and, since water is a limited resource, it will require good management practices including promotion of methods to reduce loss and wasteful use. Foremost in all future considerations of water development will be the principle of multiple use. For this to be effective, coordination and co-operation of all water users will be required to ensure that the maximum benefits are obtained from any development. The whole concept of present agricultural topdressing programs should be investigated both for economic reasons and to mitigate the problems of nutrient enrichment of waters. There is need for an urgent review of subsidy rates so that more land can be protected for posterity, and there is a need for greater emphasis on the planting of protective and productive forests for sound economic reasons as well as for conservation purposes.—Copyright 1974, Biological Abstracts, Inc.
W76-06200

INVESTIGATIONS OF AQUATIC WEED CONTROL METHODS AND THEIR ENVIRONMENTAL EFFECTS ON NONTARGET AQUATIC SPECIES.
Bureau of Reclamation, Denver, Colo. Engineering and Research Center.
N. E. Otto.
Available from the National Technical Information Service, Springfield, Va. 22161 as PB-240 191,

\$4.50 paper copy, \$2.25 in microfiche. Report No. REC-ERC-74-11, November 1974. 54 p. 9 fig., 13 tab., 31 ref., 2 append.

Descriptors: *Herbicides, *Aquatic weed control, *Effects, *Biological communities, Colorado, Algal control, Diatoms, Invertebrates, Standing crops, Biomass, Irrigation ditches, Canals, Metabolism, Productivity, Copper sulfate, Bioindicators, Performance, Copper compounds, Analytical techniques, Diquat.
Identifiers: Adenosine triphosphate, Monochlorotoluene, Xylene, Acetamide-methylurea compound.

Diatom and macroinvertebrate populations, water quality and biological data, standing crop biomass, and adenosine triphosphate levels were studied in Colorado irrigation ditches. Population data showed few differences between canals treated or untreated with herbicides. Canals treated with copper sulfate-xylene showed species diversity declines but recovered rapidly after treatment stopped. Macroinvertebrates decreased after xylene treatment, returned four days after treatment, and reached previous diversity levels in one month; diatoms recovered more slowly. Relationships between taxa diversity indices and standing crop biomass were more significant for diatoms than macroinvertebrates. Nitrate-nitrogen was higher in canals with weed growth. Taxa type and community structure were indicators of canal-riber habitats. Adenosine triphosphate was not a reliable indicator of living biomass; however gravimetric biomass determination may be less sensitive than metabolic adenosine triphosphate in determining biological productivity. Species diversity indices and chemical and physical water analyses can indicate if pesticides are harming the habitat. Evaluation of an experimental acetamide-methylurea compound and monochlorotoluene indicated that they were herbicidal to pondweeds. A mixture of three soluble copper compounds with diquat had more herbicidal activity than copper sulfate-diquat. Studies of herbicide effects or adenosine triphosphate levels on pondweeds and algae were useful in determining herbicide efficacy. (Buchanan-Davidson--Wisconsin)
W76-06218

MORE WATER FOR ARIZONA.
Arizona Water Resources Committee, Phoenix; and Arizona Water Commission, Phoenix.
For primary bibliographic entry see Field 3B.
W76-06261

ORBITAL AND HIGH ALTITUDE IMAGERY AS A MANAGEMENT TOOL FOR LAND USE AND FLOOD HAZARD STUDIES.
Arizona Univ., Tucson. Office of Arid Land Studies.
R. B. Clark, and D. A. Moutat.
Arizona Water Resources Project Information, Project Bulletin No. 12, December, 1975. 4 p.

Descriptors: *Remote sensing, *Arizona, *Land development, *Flood plain zoning, *Mapping, Land use, Land management, Urbanization, Watersheds(Basins), Flood protection, Environmental effects, Aerial photography, Satellites(Artificial), Terrain analysis.
Identifiers: Apache county(Ariz), Yavapai county(Ariz), Yuma county(Ariz).

In response to the needs of planning within Arizona, the Applied Remote Sensing Program has developed cooperative projects with several user agencies to provide information concerning such problems as flooding and erosion hazards, status of land use, and environmental impacts of proposed or existing modifications of land. Remote sensing techniques provide a rapid and current inventory of subdivisions, as well as a means for monitoring the status of development. Land use inventory projects are currently being undertaken for Apache, Yavapai, and Yuma coun-

ties in Arizona which will use the output in the land regulation process. Areas subject to flooding in Arizona have been interpreted using ERTS-1 multispectral scanner imagery and color infrared photography from the high-altitude aircraft support. These products, in combination with ground checks on sample watersheds, have generated sufficient data for several counties to come into initial compliance with state and federal legislation mandating land use controls within flood-prone areas. Land use data developed can become a base from which county officials can direct the growth of the area in such a way as to maximize the benefit derived from existing social services and utilities while avoiding potentially dangerous flood hazard areas. (Robinet-Arizona)
W76-06262

SECONDARY SUCCESSION FOLLOWING EXTENDED INUNDATION OF TEXAS COASTAL RANGELAND,
Texas A and M Univ., College Station. Dept. of Range Science.
C. J. Scifres, and J. L. Mutz.
Journal of Range Management, Vol. 28, No. 4, p 279-282, July, 1975. 3 fig, 1 tab, 3 ref.

Descriptors: *Succession, *Environmental effects, *Range grasses, *Coasts, *Floods, Ecosystems, Grasslands, Plant populations, Ranges, Texas, Rain water, Coastal bermudagrass, Grasses, Range management, Mesquite, Vegetation establishment, Vegetation, Plant growth, Burning.
Identifiers: Acacia, Setaria, Longtom (Paspalum lividum), Cynodon dactylon(L.) Pers., Sprangletops (Leptochloa spp.), Trichloris, Eragrostis, Spike dropseed (Sporobolus contractus Hitchc.).

Large areas of Texas coastal rangeland may be inundated for several years by periodic tropical storms. Prior to flooding, the land usually supports acacias-mesquite (Acacia-Prosopis) communities with herbaceous vegetation dominated by several species of Setaria. After extended inundation with fresh water, secondary succession proceeds from a sedge-sodgrass stage through a sodgrass-bunchgrass stage to a bunchgrass stage. As the water withdraws, Longtom (Paspalum lividum Torr.) initially stabilizes the area, followed by common bermudagrass, (Cynodon dactylon (L.) Pers.) as the surface dries. Sprangletops (Leptochloa spp.) are among the earliest desirable species to appear during succession, followed by species of Trichloris and Eragrostis. Spike dropseed (Sporobolus contractus Hitchc) forms a stable vegetation stage in many cases, and although highly productive, periodic burning is required for effective utilization. (Robinet-Arizona)
W76-06267

DATA COLLECTION SYSTEMS AND THEIR IMPACT ON THE FUTURE DEVELOPMENT OF HYDROLOGY,
Department of the Environment, Reading (England). Water Data Unit.
For primary bibliographic entry see Field 7A.
W76-06277

FLOOD PLAIN INFORMATION: NORTH FORK ST. LUCIE RIVER, ST. LUCIE COUNTY, FLORIDA.
Army Engineer District, Jacksonville, Fla.
Prepared for The Board of County Commissioners of St. Lucie County, November 1972. 26 p, 8 fig, 12 plates, 4 tab.

Descriptors: *Floods, *Flood forecasting, *Flood profiles, *Flood plains, Flooding, Flood flow, Hurricanes, Tidal waters, Tides, Historic floods, Flood data, Flood frequency, Peak discharge, Flood peak, Flow duration, Flood damage, Obstructions to flow, Canals, Warning systems, Control structures, *Florida.

Identifiers: Ten-Mile Creek(FA), Five-Mile Creek(FA), *St. Lucie River(FA), Intermediate Regional Flood, Standard Project Flood, Tidal flooding.

Properties in the study area flood plain are primarily agricultural and residential and have been developing because of an influx of retired people. Five-Mile Creek and Ten-Mile Creek with drainage areas of 10 and 80 sq. mi. respectively are tributary to the North Fork of the St. Lucie River with a drainage area of 590 square miles. The 1970 county population was 50, 836 and is expected to increase to 115,000 by the year 2000. Major floods occur in months June through October which coincides with the hurricane season. Seven floods have caused significant damage. A 1959 flood had a peak discharge of 4000 cubic feet per second. In an Intermediate Regional Flood a peak discharge of 2,300 cfs at the mouth of Five-Mile Creek, 9,800 cfs at the mouth of Ten-Mile Creek and 42,000 cfs on the North Fork of the St. Lucie River are predicted. This would produce a flood elevation of 15.4 feet above mean sea level which compares to the 7.6 feet msl elevation of the 1959 flood. Thirteen thousand acres of land would be flooded, 25% of which would be residential and 25% agricultural. Water velocities of 1 to 2 feet per second in the channel in the upper reaches and 1 to 3 ft/sec in the lower reaches are anticipated. During a Standard Project Flood a peak discharge of 2,900 cfs at the mouth of Five-Mile Creek, 12,200 cfs at the mouth of Ten-Mile Creek and 52,800 cfs on the North Fork of St. Lucie River are predicted. This would produce a flood elevation of 16.4 feet msl on the North Fork of St. Lucie River at White City Bridge. There are no regulatory measures in effect. (Smith - North Carolina)
W76-06282

FLOOD PLAIN INFORMATION: UVAS-CARNADERO CREEK, PAJARO RIVER TO UVAS RESERVOIR, SANTA CLARA COUNTY, CALIFORNIA.
Army Engineer District, San Francisco, Calif.
Prepared for Santa Clara County, May 1973. 20 p, 12 fig, 14 plates, 5 tab.

Descriptors: *Flood plains, Floods, *Flood profiles, *Flood stages, *Flood forecasting, Bank erosion, Warning systems, Channel improvement, Reservoirs, Peak discharge, Flow duration, Flood data, Historic floods, *California, *Flash floods.
Identifiers: Uvas-Carnadero Creek(Ca), Santa Clara County(Ca), Gilroy(Ca), Pajaro River(Ca), San Jose(Ca), Santa Cruz Mtns.(Ca).

The Uvas-Carnadero system (drainage area 90 sq mi) is approximately 26 miles long with its headwaters in the Santa Cruz Mountains, in southern Santa Clara County. It flows generally southeast to join the Pajaro River about six miles south of Gilroy. Continued area growth is expected to cause Gilroy to expand to the south and west into the primarily agricultural flood plain of Uvas-Carnadero Creek. Bridges and vegetation can be expected to obstruct flood flows. Flood damage reduction measures have been limited to channel maintenance and construction of levees by local interests. Uvas Dam, completed in 1957 by the Santa Clara Valley Water Conservation District, can serve to regulate flood flows. No storage capacity is set aside for flood control purposes, thus limiting its effectiveness. Santa Clara County Flood Control and Water District has organized an Emergency Operations Center for monitoring flood situations. Flooding can occur from November to April, normally a rapid rate of rise occurs and the flood will stay out of the bank for less than one day. The worst flood of record in December 1955 forced the evacuation of 225 persons, inundated and damaged farm land, and eroded channel banks. Peak discharge reached 14,000 cubic feet per second at the mouth of the Carnadero Creek. The Intermediate Regional Flood and the Standard Project Flood will have peak discharges of 18,900 and 21,000 cfs respectively.

tively. Channel velocities will be 4-15 ft/sec during IRF. Overbank velocities will generally be less than 4 ft/sec. Flooding in Gilroy is expected to be 6 inches to 1 ft in the area south of Sixth Street. (Henley - North Carolina)
W76-06283

FLOOD PLAIN INFORMATION: STILL AND MAD RIVERS, TOWN OF WINCHESTER, CONNECTICUT.
Corps of Engineers, Waltham, Mass. New England Div.
Prepared for the Town of Winchester, Connecticut, May 1972. 31 p, 9 fig, 7 plates, 7 tab.

Descriptors: Floods, *Flood plains, Dams, *Flood profiles, Snowmelt, *Flood forecasting, Runoff, Hurricanes, Storms, Historic floods, Peak discharge, Flood peak, Flow characteristics, Flood damage, Warning systems, Flooding, *Erosion, *Connecticut.
Identifiers: *Mad River(CN), *Still River(CN), Winchester(CN), Winsted(CN), Litchfield County(CN), Indian Meadow Brook(CN), Mill Brook(CN), Rugg Brook(CN), Berkley Pond Brook(CN), Intermediate Regional Flood, Standard Project Flood, Farmington River Basin.

Mad River (drainage area 33.3 sq. mi.) flows into the Still River (drainage area 84.4 sq. mi.) in the southeastern part of the city of Winsted which is within the town of Winchester in Litchfield County. The Mad River, characterized by rapid flow and high flood flows, is fed by Indian Meadow Brook, Mill Brook, Rugg Brook, and Berkley Pond Brook, sources of high runoff during heavy rainfall or rapid snowmelt. Flooding can occur in any season and has historically resulted from hurricanes, general rainstorms, and snowmelt. The flood of August 1955 incurred heavy urban and industrial losses in the area (damage \$21 million) and resulted in seven deaths. Peak discharges on the Mad and Still Rivers reached 15,100 and 36,300 cubic feet per second, respectively. The Intermediate Regional Flood would have peak discharge of 4,500 and 18,000 cfs on the Mad and Still Rivers respectively. The Standard Project Flood would have peak discharge of 8,000 and 22,150 cfs on the Mad and Still Rivers respectively. The IRF would result in residential, industrial, and limited commercial losses. Channel velocities would range from 5-25 ft/sec on the Mad River. Many of the 17 bridges that cross the two rivers would obstruct flow during an IRF and a SPF with erosion of channel and side bank areas. Since the disastrous flood of 1955 the Corps of Engineers has completed two projects, the Mad River Dam and Sucker Brook Dam which help control flood flows. Consequences of future flooding, however, could be increasingly costly as expected development in the flood plain occurs. (Henley - North Carolina)
W76-06284

FLOOD PLAIN INFORMATION: COASTAL AREAS, SARASOTA COUNTY, FLORIDA.
Army Engineer District, Jacksonville, Fla.
Prepared for the Board of County Commissioners of Sarasota County, May 1973. 28 p, 7 fig, 16 plates, 3 tab.

Descriptors: *Floods, *Flood profiles, *Tidal waters, *Flood plains, Flooding, Hurricanes, Tides estuaries, Historic floods, Flood peak, Flood waves, Erosion, Non-structural alternatives, Flood plain zoning, Warning systems, Gulf of Mexico, *Florida.
Identifiers: Sarasota(FA), Venice(FA), Tidal flooding, Intermediate Regional Hurricane, Standard Project Hurricane, Keys.

The coastal study area is about 35 miles long and 1 to 3 miles wide with tidal flood plain extensively developed with residences, including multi-story apartments, commercial establishments and recreation facilities. The entire county had a popu-

Field 4—WATER QUANTITY MANAGEMENT AND CONTROL

Group 4A—Control Of Water On The Surface

lation of 120,413 in 1970 and is expected to increase to 215,000 by the year 2000. The county is composed of low-lying keys with almost continuous development separated from the mainland by bays and inlets. Inflow through the inlets and overtopping of the keys in severe storms can cause flooding. Both fresh-water floods due to intense rain and tidal floods caused by hurricanes and tropical storms occur. The latter storms are likely to occur in months June through November and primarily in September and October. The largest storm in the area caused a tide of 7 feet above mean sea level (msl). Total loss was estimated at \$200,000. An Intermediate Regional Hurricane is predicted to have a central pressure of 27.45 inches of mercury, a radius of maximum winds equal to 14 nautical miles, winds of 110 mi/hour, and a forward speed of 11 knots. The tidal flood would reach an elevation of 12 feet msl along the open coast and interior coastal bays. This level would decrease about 1 foot per mile moving inland. About 17,000 acres would flood, including 10,000 developed acres and 12,000 structures. The Standard Project Hurricane would have a central pressure of 27.04 inches, a 16 nautical mile maximum radius, winds of 116 mph, and a forward speed of 18 knots. This would produce a tidal peak of 14.5 feet msl. About 28,000 acres would flood, 11,800 developed acres and 12,500 structures. City and County ordinances for zoning exist. (Smith-North Carolina)
W76-06285

DISTRIBUTION FUNCTIONS LIMITED AT THE ORIGIN (IM URSPRUNG BEGRENZTE VERTEILUNGsfunktionen).
For primary bibliographic entry see Field 2A.
W76-06316

CONTROLLING POLLUTION FROM COMBINED SEWERS.
Hydrocomp, Inc., Palo Alto, Calif.
For primary bibliographic entry see Field 5D.
W76-06328

FLOOD PLAIN INFORMATION: COASTAL AREAS, ST. LUCIE COUNTY, FLORIDA.
Army Engineer District, Jacksonville, Fla.
Prepared for the Board of County Commissioners of St. Lucie County, July 1972. 24 p, 10 fig, 12 plates, 3 tab.

Descriptors: Floods, *Flood forecasting, *Flood profiles, *Hurricanes, *Tidal waves, *Erosion, Flood plains, Flooding, Shores, Flood data, Historic floods, Flood waves, Warning systems, Bulkheads, Waves(Water), Beaches, *Florida. Identifiers: *Indian River(FA), Fort Pierce(FA), St. Lucie County(FA), Standard Project Hurricane, Tidal flooding, Intermediate Regional Hurricane, Jack Island(FA), Hutchinson Island(FA), Overtopping, Wave runup.

Properties in the portion of St. Lucie County covered here are primarily devoted to commercial fishing, the shipping industry, and other commerce. On Hutchinson Island, immediately south of Ft. Pierce Inlet, new residential development has started. If recreation demands increase as expected, development could increase rapidly. Jack and Hutchinson Islands average about 3 feet above mean sea level. An area 21 miles long and 2 to 3 miles wide separated from the rest of the county by a high ridge is described. Major floods are caused by abnormally high tides associated with a hurricane or tropical storm, generally in June through October. Flooding due to hurricane tides is generally less than 12 hours, reaching a peak in about 6 hours. A 1928 hurricane had winds over 100 mph in West Palm Beach (FA) and caused the loss of 2000 lives and considerable property damage. Relief efforts cost \$25 million. The 1949 hurricane had winds of up to 120 mph in West Palm Beach and caused 2 deaths and \$45 million in damage. In an Intermediate Regional Hurricane

tidal elevations 7.3 feet above msl is possible along the open coast and 5 feet msl in the Indian River. Runup could reach 13 feet msl. Maximum wind speeds could reach 88 mph. In a Standard Project Hurricane an elevation of 9.6 feet msl is possible in open water and 7 feet msl in the Indian River. Runup could be 12 to 15 feet msl depending on the slope. Winds are estimated at 111 mph. Hurricane tides generally rise at 1 to 2 ft/hour, peak after 6 hours, and remain above normal less than 12 hours. Water velocities higher than 3 ft/sec are likely with higher velocities in open areas under the effect of hurricanes. Extensive erosion and structural damage to buildings are anticipated. (Smith-North Carolina)
W76-06354

FLOOD PLAIN INFORMATION: VAN DUZEN RIVER, HUMBOLDT COUNTY, CALIFORNIA.
Army Engineer District, San Francisco, Calif.
Prepared for Humboldt County (CA), July 1973. 20 p, 9 fig, 13 plates, 6 tab.

Descriptors: *Floods, *Flooding, *Flood profiles, *Historic floods, *Flood plains, Streamflow forecasting, Flood data, Flood Frequency, Peak discharge, Obstruction to flow, Non-structural alternatives, Flood plain zoning, Levee, *California. Identifiers: *Van Duzen River(CA), Humboldt Co(CA), Alton(CA), Yager Creek(CA), Bridgeville(CA), Hydesville(CA), Carlotta(CA), Eel River(CA), Intermediate Regional Flood, Standard Project Flood.

Land in this study area is used as ranches and farms in the canyon through which the Van Duzen and its tributaries run, though most of the development occurs in the floodplain at the mouth of the Van Duzen in the communities of Alton, Hydesville and Carlotta. The drainage area of the Van Duzen is 417 square miles downstream from Yager Creek. The river flows through steep, narrow-sided canyons at an average slope of 11 feet per mile. Normal annual precipitation is from 40 to 70 inches, and about 40% of the rain occurs in December and January. Six gaging stations operate on the Van Duzen River and records from these indicate the largest flood occurred in 1964 when the peak discharge was 48,700 cubic feet per second. At this time the Yager Creek had a peak discharge of 30,000 cfs. This flood caused damage estimated at \$4,000,000 and one bridge was destroyed. In the event of an Intermediate Regional Flood a peak discharge of 94,000 cfs at the mouth of the Van Duzen River along with water velocities of 6 to 10 ft/sec in the channel in the upper reaches and 3 to 6 ft/sec in the lower reaches is predicted. The flood plain is classed as rural and 3000 acres are subject to flooding. The flood would rise 9 feet in about 40 hours and floodstage would last 71 hours. In a Standard Project Flood a peak discharge of 117,000 cfs is predicted and water velocities slightly higher than the Intermediate Regional Flood. The flood would rise 10 feet in 40 hours and floodstage would last 76 hours. None of the 3 bridges on the Van Duzen would be obstructive to either flood unless there is debris accumulation. (Smith-North Carolina)
W76-06355

FLOOD PLAIN INFORMATION: SAN TIMOTEO CREEK, VICINITY OF LOMA LINDA, SAN BERNARDINO COUNTY, CALIFORNIA.
Army Engineer District, Los Angeles, Calif.
Prepared for San Bernardino County Flood Control District, June 1973. 55 p, 49 fig, 22 plates, 5 tab.

Descriptors: Flood flow, *Flood profiles, *Flood damage, *Flood plains, *Flood data, *Flood forecasting, *Erosion, Deposition, Storms, Flood frequency, Flood stages, Peak discharge, Flow duration, Flood peak, Floodways, Channels, Warning systems, Zoning, Channel improvement, *California.

Identifiers: San Bernardino County(Ca), San Timoteo Creek(Ca), Loma Linda(Ca), Riverside County(Ca), Santa Ana River(Ca), Wilson Creek(Ca), Redlands(Ca), Colton(Ca), San Bernardino(Ca), Bryn Mawr(Ca), Noble Creek(Ca), San Geronimo Creek(Ca), Intermediate Regional Flood, Standard Project Flood.

The study area is the 6.5 mile reach of San Timoteo Creek from about 1 mile downstream from the San Bernardino-Riverside County boundary, to its confluence with the Santa Ana River, draining an area of 126 sq mi in southwestern San Bernardino County. This area includes Noble and Little San Geronimo Creeks, the City of Loma Linda (population 10,000), parts of the cities of Redlands, Colton and San Bernardino, and the community of Bryn Mawr. Development in the flood plain consists of commercial (truck-stops, railroad sidings, storage yards), residential (light to medium density) and agricultural (citrus groves) uses. Continued development is expected. Flooding has historically occurred (13 large floods in the past 100 years) as the result of general summer storms, local summer storms and general winter storms. In January and February 1969 floods in San Bernardino County left 13 dead with \$54 million damage. Damages in the San Timoteo study area (estimated at \$6 million) were increased by the incidence of severe erosion, mudslides and the deposition of sediments (2-3 feet in portions of Loma Linda). The February flood, designated as a 50 year flood, is compared with the Intermediate Regional Flood and the Standard Project Flood, which would have peak discharges of 24,000 and 46,000 cubic feet per second respectively at the San Bernardino-Riverside County line. During IRF, channel and overbank velocities would reach 12-20 and 4-8 ft/sec respectively. Deposition and erosion will occur at bridges and embankments. Flood control efforts by San Bernardino County include channel improvements and flood plain zoning regulations (not yet covering the study area). (Henley-North Carolina)
W76-06356

FLOOD PLAIN INFORMATION: UPPER ST. VRAIN CREEK, VOLUME IV, BOULDER COUNTY, COLORADO.
Army Engineer District, Omaha, Nebr.
Prepared for City of Longmont and Boulder County, September, 1972. 24 p, 13 fig, 10 plates, 8 tab.

Descriptors: *Floods, *Flood flow, *Flood plains, *Flood stages, *Snowmelt, *Flood profiles, Runoff, Historic floods, Flood data, Flood frequency, Peak discharge, Flood peak, Flow duration, Flow characteristics, Floodways, Flood damage, Channels, Planning, Dams, *Colorado. Identifiers: St. Vrain Creek(Co), Boulder County(Co), Lyons(Co), North St. Vrain Creek(Co), South St. Vrain Creek(Co), Rocky Mountains(Co), Intermediate Regional Flood, Standard Project Flood, Longmont(Co).

The study reach extends upstream from the confluence of two streams at Lyons (drainage area at Lyons 219 sq. mi.), 3.7 miles along the North St. Vrain Creek, and 1.5 miles along the South St. Vrain Creek, and downstream from the confluence point along St. Vrain Creek for 5.2 miles. St. Vrain Creek slopes between 42-48 ft/mi. The channel bed has cobbles and small boulders. Development in the flood plain includes residential and commercial uses. Pressure for more flood plain development is expected as Lyons (population 958) continues to grow due to the lack of suitably sloped land in the area plus the attraction of living near the stream. Eleven bridges, raised road surfaces and residential development can obstruct flood flows. Flooding (9 floods in the last 108 years) has occurred from May through September as the result of snowmelt runoff combined with rainfall. Peak flood is usually reached within several hours of the rainfall event. Flood duration is normally short but can be prolonged by continued rapid snowmelt. The Intermediate Re-

gional Flood and the Standard Project Flood will have peak discharges of 10,700 and 28,300 cubic feet per second respectively. In addition to scattered residences along the flood plains the IRF can be expected to flood large portions of the town of Lyons. Overbank flow velocities should be expected to be hazardous in Lyons and upstream. Downstream from Lyons, special care must be taken in road and building construction since modifications of the flood plain can alter flood patterns and inundate lands not now affected by flooding. (Henley-North Carolina)
W76-06357

FLOOD PLAIN INFORMATION: SALMON BROOK, EAST BRANCH AND WEST BRANCH, GRANBY AND E. GRANBY, CONNECTICUT.
Corps of Engineers, Waltham, Mass. New England Div.
January 1974. 26 p, 19 fig, 20 plates, 6 tab.

Descriptors: *Flood plains, *Channels, *Flood flows, *Flood peak, *Flood profiles, *Flood forecasting, Runoff, Storms, Hurricanes, Bank erosion, Flood data, Historic floods, Flow duration, Flow characteristics, Warning systems, Snowmelt, *Connecticut.
Identifiers: Salmon Brook(CN), East Branch Salmon Brook(CN), West Branch Salmon Brook(CN), Granby(CN), East Granby(CN), Farmington River(CN), Standard Project Flood, Intermediate Regional Flood, Hartford(CN).

Portions of the towns of Granby and East Granby, Connecticut, are subject to flooding from this 16.5 mile reach of Salmon Brook and its West and East Branches (drainage area 67.3 sq. mi.). Located in north central CN, these streams are tributaries of Farmington River. The flood plains of Salmon Brook, ranging up to 1,500 ft. in width, contain residential, commercial and farm development in the Granby area. Vegetation, 12 bridges, and narrow channel widths can restrict floodflows. Flood flows can occur in any season from general rainstorms which can be augmented by snowmelt and storms from tropical hurricanes that travel up the Atlantic seaboard. Major floods are most likely to occur in the spring, characterized by duration of from 12-36 hours. Backwater effects at the confluence of the East and West Branches as well as at Salmon Brook's confluence with Farmington River can increase flood heights during flood conditions. Flooding in August, 1955 did \$3,500,000 damage in Granby and East Granby to residential, industrial, commercial and agricultural development. Peak discharge reached 40,000 cubic feet per second on Salmon Brook during this flood and can be expected to reach 29,700 cfs and 39,600 cfs during the Intermediate Regional Flood and Standard Project Flood respectively with mean channel velocities of 2-5 ft/sec. Velocities under the Penn-Central Railroad bridge are estimated for the IRF and SPF to be 15 and 17 ft/sec respectively, causing extreme erosion. (Henley-North Carolina)
W76-06358

FLOOD PLAIN INFORMATION: CYPRESS CREEK, ORANGE COUNTY, FLORIDA.
Army Engineer District, Jacksonville, Fla.
Prepared for the Board of County Commissioners of Orange County, November 1971. 16 p, 1 fig, 6 plates, 1 tab.

Descriptors: *Floods, *Flooding, *Flood forecasting, *Flood profiles, *Flood plains, Lakes, Bulkheads, Runoff, Hurricanes, Historic floods, Peak discharge, Erosion, *Florida.
Identifiers: Cypress Creek(FA), Standard Project Flood, Intermediate Regional Flood, Windermere(FA), Tropical floods.

Population in this sub-tropical area of Florida is now 1000 but rapid growth is expected because of the tremendous expansion of Orlando 8 miles away. Considerable development is anticipated on the flood plain which has residences, streets, utili-

ties and citrus groves unless adequate land use policies are adopted. Cypress Creek drains a total of 31 sq mi and flows through a basin 12 miles long and varying from 1 to 4 miles in width. The basin has a central chain of lakes which first fill to capacity in heavy rains and then overflow into the Cypress Swamp which is drained by two 5-foot culverts. In the past minor damage has been caused to low roads and some residences. Information on flooding, available from newspaper accounts and limited gaging records, indicates that most major floods occur during the passage of hurricanes and tropical storms through or near the study area in late summer or early fall. Annual precipitation averages about 52 inches with 75% of rain falling in June through October. In an Intermediate Regional Flood a peak elevation of 102.3 ft in the northern part of the basin and 101.2 ft in the southern part can be expected. A total of 1950 acres could be flooded. Waves as high as 2 ft could be generated if windspeeds from a tropical storm reach 40 mph. Rates of flood rise should be low and several days advance warning should be possible. Peak stage should last several days and waters could be above normal high stage for a month or more. In a Standard Project Flood maximum elevations of 103.2 ft in the northern part of the basin and 101.5 ft in the southern part can be expected. There are no existing or planned Federal flood control projects, but some individuals have built bulkheads along the shores of some of the lakes which prevent some erosion. (Smith-North Carolina)
W76-06359

THE BLACK HILLS (SOUTH DAKOTA) FLOOD OF JUNE 1972: IMPACTS AND IMPLICATIONS.
Forest Service (USDA), Fort Collins, Colo. Rocky Mountain Forest and Range Experiment Station.
For primary bibliographic entry see Field 2E.
W76-06360

RECOVERY FROM SOIL COMPACTION ON BLUEGRASS RANGE IN THE BLACK HILLS.
Forest Service (USDA), Fort Collins, Colo. Rocky Mountain Forest and Range Experiment Station.
For primary bibliographic entry see Field 4D.
W76-06362

TREND SURFACE ANALYSIS OF POWDER RIVER BASIN, WYOMING - MONTANA.
Forest Service (USDA), Fort Collins, Colo. Rocky Mountain Forest and Range Experiment Station.
In: Proc. Fort Union Coal Field Symp., Vol 3: Reclamation section, p. 280-288. (Montana Acad. Sci., Billings, April 1975), 5 fig, 9 ref.

Descriptors: *Land reclamation, *Terrain analysis, *Regression analysis, *Landscaping, *Aesthetics, Landshaping, Slopes, Land use, Geomorphology, Wyoming, Montana.
Identifiers: Premining inventory of landscape, Quantitative geomorphology, *Powder River Basin(Wyo-Mont).

Trend (regression) surface analysis provides a convenient means of understanding spatially variable information. Thus topographic parameters graphically displayed as isopleths are used to evaluate quantitatively the topography of the coal strip mining areas of Wyoming and Montana. The analysis is expected to provide insight into basic questions of surface reclamation including the following: (1) how closely should topography be returned to the way it was before mining. (2) what landscape design needed so that the mine spoil areas can aesthetically blend into the undisturbed landscape. (3) what changes in surface and subsurface hydrology can be anticipated between disturbed and undisturbed lands. (Forest Service)
W76-06363

COAL MINE SPOIL AS A GROWING MEDIUM: AMAX BELLE AYE SOUTH MINE, GILLETTE, WYOMING.
Forest Service (USDA), Fort Collins, Colo. Rocky Mountain Forest and Range Experiment Station.
For primary bibliographic entry see Field 5G.
W76-06364

FLOOD OF JUNE 1971 FORT NELSON AND MUSKWA RIVERS.
Department of the Environment, Vancouver (British Columbia). Inland Waters Directorate (Pacific Region); and Department of the Environment, Vancouver (British Columbia). Water Resources Branch.
For primary bibliographic entry see Field 2E.
W76-06367

SURFACE WATER DATA, REFERENCE INDEX, CANADA 1975.
Canada Centre for Inland Waters, Burlington (Ontario); and Department of the Environment, Ottawa (Ontario). Water Resources Branch.
For primary bibliographic entry see Field 7C.
W76-06377

A COMBINED MODEL OF WATER TABLE AND RIVER STAGE EVOLUTION.
Colorado State Univ., Fort Collins. Engineering Research Center.
For primary bibliographic entry see Field 2A.
W76-06380

RECOVERY FROM SOIL COMPACTION ON BLUEGRASS RANGE IN THE BLACK HILLS.
Forest Service (USDA), Rapid City, S. D. Rocky Mountain Forest and Range Experiment Station.
For primary bibliographic entry see Field 2G.
W76-06405

ADVANCES IN HYDROSCIENCE, VOLUME 10-1975.
For primary bibliographic entry see Field 8B.
W76-06412

THEORY OF WEIRS.
Indian Inst., of Science, Bangalore. Dept. of Civil Engineering.
For primary bibliographic entry see Field 8B.
W76-06416

PUBLIC INVOLVEMENT IN THE CORPS OF ENGINEERS PLANNING PROCESS.
Institute for Water Resources (Army), Fort Belvoir, Va.
For primary bibliographic entry see Field 6B.
W76-06417

DETERMINATION OF OPTIMUM QUANTITY OF SERVICE WATER OBTAINABLE FROM ONE DAM SYSTEM.
Kyushu Inst. of Tech., Kitakyushu (Japan). S. Murakami.
Journal of Hydrology (Amsterdam), Vol. 28, No. 2/4, p. 229-244, February 1976. 6 fig, 6 tab, 10 eqs, 3 ref.

Descriptors: *Dams, *Markov processes, *Probability, Monthly, Constraints, Water supply, Reservoirs, Least squares method, Optimization, Reservoir releases, Systems analysis, Mathematical models, Equations.
Identifiers: *Operating rule, Heuristic programming, *Japan, Emptiness.

The monthly operating rule of a one-dam system is considered. The monthly inputs into the reservoir are approximated by Gamma-type distributions and output is constant in a period of a month. The mathematical model of the discrete dam system is

Field 4—WATER QUANTITY MANAGEMENT AND CONTROL

Group 4A—Control Of Water On The Surface

treated as a Markov chain model. The problem is how to determine the optimum quantity in each month so as to maximize the yearly obtainable water from a dam, under the constraint that the probability of reservoir emptiness is less than 0.1. To solve this problem, heuristic programming is used. The numerical results of the optimum quantity in each month under the above constraint are shown by using the input data of real reservoirs in Japan. This method may also be applied to the problem of how to allocate the monthly release from a multi-reservoir system so as to satisfy the demand of water of a city. (Bell-Cornell) W76-06419

EVALUATION OF SHORT-TERM OPERATIONAL POLICIES FOR A MULTI-PURPOSE RESERVOIR SYSTEM,
Water Resources Board, Reading(England).
D. G. Jamieson, D. K. Smith, and J. C. Wilkinson.
Journal of Hydrology, Vol. 28, No. 2/4, p 191-213, February 1976. 4 fig, 2 tab, 8 ref.

Descriptors: *Multiple-purpose reservoirs, *Water policy, *Evaluation, *Short-term planning, Water supply, Management, Flood control, Reservoir operation, Simulation analysis, Constraints, Mathematical models, Systems analysis.
Identifiers: *Operating rules, United Kingdom.

As water supply demands on existing river-regulation schemes increase, it may be possible to defer large capital expenditure by operating the existing system more efficiently, since wastage due to inefficient management can account for up to 22 percent of the total reservoir storage capacity. While not all floods can be contained by component reservoir management, many can be mitigated by careful operation of the reservoir sluices. Considered is the short-term control strategy for the management of multi-purpose reservoirs for water supply and flood alleviation in the River Dee system. As a first step towards implementation, the existing operating rules have been compared objectively to the proposed control policy, and this is reported concerning the short-term strategy. The objective of the present control policy is to contain the high flows of the catchment's headwaters in the reservoirs while the peak flows of the down stream portion of catchment pass down the main channel. Considering the proposed operation procedure, a comprehensive telemetry scheme is being installed on the Dee catchment; the optimal control of the reservoir sluices depends on the ability to forecast future flow sequences. A hydrologic simulation package (DISPRIN) acts of the telemetered rainfall data and upstream tributary flows to produce forecast hydrographs which are routed through reservoirs, if appropriate, and down the main river channel. Whereas the existing control rules attempt a compromise between flooding to critical areas, the proposed strategy gives preference to the area around Llyn Tegid. (Bell-Cornell) W76-06420

RELEASE CONTROL POLICY FOR A LARGE LAKE SUBJECT TO WIND WAVES,
Water Resources Center, Budapest (Hungary).
I. Bogardi, L. Duckstein, and W. A. Metler.
Journal of Hydrology (Amsterdam), Vol. 28, No. 2/4, p 175-190, February 1976. 3 fig, 3 tab, 3 equ, 7 ref.

Descriptors: *Lakes, *Control, *Water policy, *Water levels, *Dynamic programming, *Stochastic processes, Reservoir releases, Methodology, Monthly, Water storage, Shores, Damages, Hydrologic aspects, Economics, Optimization, Inflow, Equations, Algorithms, Mathematical models, Systems analysis, *Risks.
Identifiers: Lake Balaton(Hungary), Computational procedures.

Presented is a methodology for controlling the level of a large and shallow lake subject to a dou-

ble uncertainty in the state of nature. The two uncertainty components are: (1) average monthly static water level, which determines benefits and losses associated with tourism and storage of water; and (2) monthly maximum dynamic water level, which may cause extensive shore damage. The computational procedure for finding the optimum control policy utilizes stochastic dynamic programming. The methodology is demonstrated by means of the case study of Lake Balaton in Hungary where data on the water level rise caused by wind are available. The model for dependent monthly inflows has been computerized and implemented on the CDC 6400 at the University of Arizona. (Bell-Cornell) W76-06421

CONTROL OF A RIVER SYSTEM WITH TWO STORAGE RESERVOIRS,
Birmingham Univ. (England). Dept. of Civil Engineering.
M. J. Hamlin, N. T. Kottegoda, and T. Kitson.
Journal of Hydrology (Amsterdam), Vol. 28, No. 2/4, p 155-173, February 1976. 4 fig, 1 tab, 10 ref.

Descriptors: *Water storage, *River systems, *Reservoirs, *Control, River regulation, Water policy, Water yield, Operations research, Hydrologic aspects, Simulation analysis, Low flow, Computer models, Reservoir releases, Constraints, Equations, Mathematical models.
Identifiers: *Severn River(England), Vyrnwy reservoir(England), Predictive models, Regulation losses, Bivariate model, Synthetic data.

Described is a system in which a number of controls are used for operational purposes. Some of these controls have been determined purely empirically as in the case of flood alleviation. The controls which protect the firm withdrawal requirements for water supply purposes from Vyrnwy reservoir are determined statistically and the control of reservoir releases for river regulation purposes are based on a crude predictive model. The investigation was undertaken to determine whether rescheduling of statutory releases from the Vyrnwy reservoir could be effectively used to improve regulation of the River Severn and thus increase the quantity of water which could be abstracted without additional capital expenditure. Regulation losses can be substantial when there is a travel time of five days, as in this case, between the reservoir and the river control point. The possibility of reducing this loss by constructing bank-side storage low down in the catchment is also considered. (Bell-Cornell) W76-06422

CONTROL OF ABSTRACTION BY LAW,
For primary bibliographic entry see Field 6E.
W76-06423

VIABILITY OF EXISTING WATER RESOURCE MODELS, THE POTOMAC RIVER BASIN WATER SUPPLY ALTERNATIVES,
Interstate Commission on the Potomac River Basin, Bethesda, Md.
For primary bibliographic entry see Field 6A.
W76-06424

APPLICATION OF MULTI-REGIONAL PLANNING MODELS TO THE SCHEDULING OF LARGE-SCALE WATER RESOURCE SYSTEMS DEVELOPMENT,
Geological Survey, Reston, Va.
For primary bibliographic entry see Field 6A.
W76-06425

CASE STUDY: FOR THE ANALYSIS OF WATER MANAGEMENT INVESTMENTS ON HAND OF THE EXAMPLE OF THE KISKORE RIVER BARRAGE AND ITS IRRIGATION SYSTEMS,
G. Reich.

Working Paper No. 54, UNDP/UN Interregional Seminar on River Basin and Interbasin Development, Budapest, Hungary, September 1975 (Paper in French). 2 fig, 3 tab, 6 ref. (United Nations, Department of Economic and Social Affairs).

Descriptors: *Water management(Applied), *Investment, *Irrigation systems, *Economic efficiency, Social aspects, Effects, Projects, Costs, Arid lands, Europe.
Identifiers: *Tisza River Valley(Hungary), *Kiskore River Barrage(Hungary), Arid regions.

The Tisza Valley in Hungary is plagued by an increasingly serious water shortage. The canalization of the Tisza River is important in solving the problem of increasing demands for water. The most important link in the canalization is the Kiskore River Barrage and the complex system of projects connected with it. The purpose and the technical capacity figures of the system of projects and the characteristic features of their implementation are described. Included is a formulation of the perspective socio-economic effect of the system (investments and expected economic benefits) and an attempt to quantify its economic efficiency. Economic efficiency is evaluated in two different ways. This is carried out partly from an economic point of view—using prices of 1972—and partly by forming dynamic indices projected onto the year 1973, the financial main point of the investments continued and benefits carried into effect in a long period. Beside efficiency (profit return) indices, the specific costs of the projects and of the benefits produced are given as auxiliary indices. It can be stated as a final conclusion that both expected perspective socio-economic effects and the efficiency of the system of projects will form in accordance with those planned. (Bell-Cornell) W76-06427

COOPERATIVE MANAGEMENT AND DEVELOPMENT OF INTERNATIONAL RIVER BASINS,
Cornell Univ., Ithaca, N.Y. School of Civil and Environmental Engineering.
L. B. Dworsky.

Working Paper No. 50, UNDP/UN Interregional Seminar on River Basin and Interbasin Development, Budapest, Hungary, September 1975. 2 charts, 18 ref, 22 p.

Descriptors: *River basin development, *Management, International commissions, Water policy, Hydrologic aspects, Economics, Decision making, Organizations, Behavior, International law, Planning.
Identifiers: *International cooperation.

This general report has three objectives, all of which follow the guidelines provided by the Seminar organizers. First, it presents some specific factors influencing cooperation among co-basin countries and discusses problems and issues affecting international water management organizations. Second, it views a number of background reports and conference papers in the light of these factors and identifies illustrative types of resource situations from these and other sources. Third, it proposes a number of questions for consideration by the Seminar and its work groups with the expectation that the results of discussions will provide substantive material for the 1977 United Nations Water Conference. Considered are factors influencing cooperation, hydrologic-economic incentives, international relations, policy-making and implementation, general problems and issues, organizational behavior, decision-making analysis, areas of international conflict, commission structure, and reviews concerning international activities, with case studies and resource situations. (Bell-Cornell) W76-06428

RIVER BASIN DEVELOPMENT FOR SOCIO-ECONOMIC GROWTH, National Water Authority, Budapest (Hungary). Dept. of Water Management Policy. L. David.

Working Paper No. 52, UNDP/UN Interregional Seminar on River Basin and Interbasin Development, Budapest, Hungary, September 1975. 2 fig, 7 eq, 19 ref. (United Nations, Department of Economic and Social Affairs).

Descriptors: *River basin development, *Comprehensive planning, *Optimum development plans, *Water resources, Social aspects, Economics, Growth, Constraints, Equations, Optimization, Water demand, Water supply, Runoff, Systems analysis, Mathematical models. Identifiers: Interdisciplinary planning.

This general report analyzes the inseparable connection between socio-economic growth (SEG) and river basin development (RBD), considering RBD as a subsystem of SEG. The concept of comprehensive river basin development is discussed, its systems analysis is presented, and main conditions and means of the reasonable implementation of RBD are determined. A set of conclusions and proposals for further action is listed. The purpose of RBD is to achieve the optimum use of natural water resources on basin-wide scale during socio-economic development. The criteria of optimum use depend at all times on the constraints of SEG. RBD is a comprehensive, man-made process involving social, economic, technical, environmental, and natural elements, discussed herein in detail. The RBD process has three basic evolution periods and needs to be planned and controlled using systems analysis. The evaluation of alternative development policies and strategies can be attained using optimization techniques and mathematical models. A comprehensive, interdisciplinary approach is of growing importance, covering simultaneously the technical, economic, social, legal and administrative aspects, including problems of uncertainties. The proposals listed cover, among others, the process analysis of RBD and the development of long-range river basin planning methods, techniques and data collection. (Bell-Cornell) W76-06429

WATER QUALITY CONTROL SYSTEM OF ZAGYVA RIVER BASIN, Research Inst. for Water Resources Development, Budapest (Hungary). For primary bibliographic entry see Field 5G. W76-06430

LONG-TERM OPERATION OF STORAGE HYDRO PROJECTS, British Columbia Univ., Vancouver. Dept. of Civil Engineering. W. F. Caselton, and S. O. Russell. Journal of the Water Resources Planning and Management Division, Proceedings of the American Society of Civil Engineers, Proceedings Paper NO. 12089, Vol. 102, No. WR1, p 163-176, April 1976. 5 fig, 1 tab, 9 ref.

Descriptors: *Water resources, *Probability, *Reservoir storage, *Hydroelectric power, *Powerplants, Methodology, Optimization, Energy, Computers, Operations research, Projects, Long-term planning, Mathematical models, Equations, Systems analysis. Identifiers: *Systems engineering, Decomposition approach.

The introduction of large storage hydroelectric projects into an existing mixed hydro and thermal generating system increases the need for sound long-term operating policies and system development plans. The complexity of the integrated overall operation of such a generating system is too great for direct application of optimization techniques. This paper describes a methodology

which performs a detailed optimization of the long-term operation of a part of the generating system, comprising a large storage hydro project and a thermal plant, under varying conditions of thermal capacity and firm energy demand. When the methodology was applied to an actual large storage hydro project the results provided considerable insight into the long-term integrated operating characteristics of hydro and thermal plants. A basis for coordinating long-term operation with the large storage hydroprojects is suggested. The methodology involves decomposing the system into separate hydrothermal subsystems and analyzing each with a special algorithm. The method finds the best way to integrate the operation of a mixed hydrothermal electric power generation system where one or more of the reservoirs are large enough to provide overyear storage. (Bell-Cornell) W76-06434

FLOOD DAMAGE REDUCTION POTENTIAL OF RIVER FORECAST, Wisconsin Univ., Green Bay. Coll. of Environmental Science. For primary bibliographic entry see Field 6F. W76-06435

A PRACTICAL MONTHLY OPTIMUM OPERATIONS MODEL, Bureau of Reclamation, Sacramento, Calif. Mid-Pacific Regional Office; and Bureau of Reclamation, Sacramento, Calif. Water and Power Control Div. D. M. Fults, L. F. Hancock, and G. R. Logan. Journal of the Water Resources Planning and Management Division, Proceedings of the American Society of Civil Engineers, Proceedings paper No. 12063, Vol. 102, No. WR1, p 63-76, April 1976. 7 fig, 1 tab, 4 ref.

Descriptors: *Water resources, *Forecasting, *Mathematical models, *Computer programs, Engineering, Systems analysis, Dynamic programming, Multiple-purpose projects, Operations research, Projects, Equations, Algorithms, Reservoirs, Water policy, *Optimization, Constraints, Flood control, *California. Identifiers: Operating policy, *Central Valley Project(Calif).

A mathematical model is developed for the Central Valley Project in California. The model produces a 12-month operating policy; it is programmed in FORTRAN IV for processing on a CDC CYBER 74 computer. Project operations managers are using the model as a decision-advising tool. This model will be coupled with a daily strategy mode. A four-dimensional dynamic programming algorithm is developed to optimize the operation of the four-reservoir system. The objective of the model is to maximize energy generation within the limits of firm water and power contracts, mandatory releases, and flood control. A unique technique given the acronym RecIP for recomputed initial policy is developed to compute the initial operating policy that is optimized. The RecIP technique is an iterative process using the results of the incremental dynamic programming algorithm to compute a new initial policy to satisfy the required end of operational period target storages desired by the user. (Bell-Cornell) W76-06436

DIVERSION OF WATER THROUGH NORTHFIELD MT. PUMPED STORAGE PROJECT, Stone and Webster Engineering Corp., Boston, Mass. Water Resources Group. C. W. Lockwood. Journal of the Water Resources Planning and Management Division, Proceedings of the American Society of Civil Engineers, Vol. 102, No. WR1, Proceedings paper No. 12075, p 49-62, April 1976. 9 fig, 1 tab, 2 ref.

Descriptors: *Water resources, *Water supply, *Pumped storage, *Inter-basin transfers, Diversion, Inlets(Waterways), Pumping, Reservoirs, Water quality, Projects, *Connecticut River. Identifiers: Northfield Mt. pumped storage project(Mass).

Provisions were made at the Northfield Mountain Pumped Storage Project for the diversion of 26 billion gallons or 79,800 acre-ft of water per year from the Connecticut River to the Quabbin Reservoir. The outlet works including gates, fish screens, stop logs, metering devices, and transmitting and recording devices were provided by Northeast Utilities. During periods of flood flow in the Connecticut River, excess flow will be pumped into reserve space in the upper reservoir by use of the main pump-turbine units and this will then be permitted to run through the diversion works which include the outlet works and the proposed aqueduct to the Quabbin Reservoir. Northeast Utilities is cooperating with the Commonwealth of Massachusetts in the proposed development of this source of water supply. This diversion project utilizing a pumped storage hydroelectric power project to augment a municipal water supply is unique and important. (Bell-Cornell) W76-06437

FLOOD-PRONE AREAS OF GADSDEN COUNTY, FLORIDA, Geological Survey, Tallahassee, Fla. For primary bibliographic entry see Field 7C. W76-06443

WATER RESOURCES OF THE THRUST BELT OF WESTERN WYOMING, Geological Survey, Cheyenne, Wyo. For primary bibliographic entry see Field 7C. W76-06448

PHYSICAL AND CLIMATIC CHARACTERISTICS ALONG KANSAS STREAMS, Geological Survey, Lawrence, Kans. For primary bibliographic entry see Field 7C. W76-06450

WATER RESOURCES DATA FOR GEORGIA, WATER YEAR 1975, Geological Survey, Doraville, Ga. For primary bibliographic entry see Field 7C. W76-06451

GEOLOGIC AND WATER-SUPPLY REPORTS AND MAPS—WYOMING, JULY 1975, Geological Survey, Reston, Va. For primary bibliographic entry see Field 10C. W76-06456

EROSION AND SEDIMENT TRANSPORT IN THE OWENS RIVER NEAR BISHOP, CALIFORNIA, Geological Survey, Menlo Park, Calif. For primary bibliographic entry see Field 2J. W76-06458

INFLATABLE WATER-RETAINING BARRIER, Pneumatiks, Caoutchouc Manufacture et Plastiques Kleber-Colombes (France), (Assignee). For primary bibliographic entry see Field 8A. W76-06462

WATER RESOURCES DEVELOPMENT OF INTERNATIONAL RIVERS WITH SPECIAL REFERENCE TO THE DEVELOPING WORLD, West Indies Univ., Barbados. School of Law. P. K. Menon. International Lawyer, Vol. 9, No. 3, p 441-464 (1975). 24 p.

Field 4—WATER QUANTITY MANAGEMENT AND CONTROL

Group 4A—Control Of Water On The Surface

Descriptors: *Coordination, *Water resources development, *Rivers, *International law, *Conservation, Planning, Agriculture, River basins, Data collections, Construction, Maintenance, Consumptive use, International waters, Irrigation, Riparian rights, Flood control, Navigation, Prior appropriation, Dams, Industries, Electric power.
Identifiers: *International cooperation.

The rational utilization and optimum development of international water resources require cooperative and concerted action by riparian states on the basis of legal principles defining rights and obligations. International water law, which is not well developed at this time, can be divided into four categories: territorial integrity, absolute sovereignty, community in the waters, and limited territorial sovereignty. In the developed nations, controversies regarding the utilization and control of international rivers have been settled through agreements between the nations involved. In the developing nations, the trend of legal arrangements is taking on different features, including: (1) integrated basin development with multi-purpose projects and basin-wide programs; (2) joint and coordinated action; (3) community interests; (4) limitation of sovereignty; and (5) respect for national sovereignty. The administrative question that arises in undertaking the construction of projects is whether construction should be done by a joint agency or divided between the countries. A similar problem arises with respect to operation and maintenance of the projects. Where a joint agency is established for construction, it may be necessary to have special agreements concerning the proper laws to be applied. (Segall-Florida)
W76-06486

FLOOD PLAIN AND TSUNAMI INUNDATION AREA ORDINANCE.

For primary bibliographic entry see Field 6F.
W76-06492

SAMPLE SUBDIVISION CONTROL ORDINANCE FOR FLOOD HAZARD AREAS.
Minnesota Dept. of Natural Resources, St. Paul.
For primary bibliographic entry see Field 6F.
W76-06494

REORIENTATION OF URBAN WATER RESOURCES RESEARCH, FINAL REPORT.
Rutger-The State Univ., New Brunswick, N.J. Water Resources Research Inst.
For primary bibliographic entry see Field 6B.
W76-06553

REORIENTATION OF URBAN WATER RESOURCES RESEARCH, EXECUTIVE SUMMARY.
Rutger-The State Univ., New Brunswick, N.J. Water Resources Research Inst.
For primary bibliographic entry see Field 6B.
W76-06554

EVALUATION OF POLLUTION ABATEMENT TECHNIQUES APPLICABLE TO LOST CREEK AND BROWN'S CREEK WATERSHED, WEST VIRGINIA.
Ackenhell and Associates Geo Systems, Inc., Pittsburgh, Pa.
For primary bibliographic entry see Field 5G.
W76-06570

DEVELOPMENT OF A PRIORITY DETERMINATION PROCEDURE.
Rivkin/Carson, Inc., Washington, D.C.; and Edwards (Arthur) Associates, Washington, D.C.
For primary bibliographic entry see Field 5G.
W76-06571

A PROPOSAL FOR FUTURE UTILIZATION OF THARTHAR LAKE WATER.
Institute for Applied Research on Natural Resource, Baghdad (Iraq).
For primary bibliographic entry see Field 3C.
W76-06577

DRAINAGE AND RECLAMATION PERFORMANCE AT THE IMAM EXPERIMENTAL FIELD IN THE GREATER MUSSAYEB PROJECT, A MONITORING STUDY.
Institute for Applied Research on Natural Resources, Baghdad (Iraq).
For primary bibliographic entry see Field 3C.
W76-06581

DYNAMICS OF MARSH LAND FORMATION AND SUCCESSION ALONG THE LOWER COLORADO RIVER AND THEIR IMPORTANCE AND MANAGEMENT PROBLEMS AS RELATED TO WILDLIFE IN THE ARID SOUTHWEST.
Arizona State Univ., Tempe.
R. D. Ohmart, W. O. Deason, and S. J. Freeland.
In: Transactions of the 40th North American Wildlife and Natural Resources Conference, 1975, Published by the Wildlife Management Institute, Washington, D.C., p. 240-251 (1975). 9 fig, 1 tab.

Descriptors: *Colorado River, *Wildlife, *Habitat improvement, *Freshwater marshes, *Succession, Ecology, Wildlife conservation, Wildlife management, *Marsh management, Riparian plants, Aquatic habitats, Southwest U.S., Arid lands, Saline water, Environmental effects, Marshes.
Identifiers: *Topock Marsh, Beaver Lake, Lake Su-ta-nah, Duck Lake, Hunters Hole, Powell Slough, Lake Tapio, Blankenship Bend, Lake Havasu, Three Fingers Lake.

Historical evidence indicates that backwater marsh situations were never very extensive or enduring (50 to 70 years) along the lower Colorado River (delta excluded). These backwaters have been and remain important habitats for many forms of wildlife, but may become useless to some wildlife in a few years because of salinization and anoxia. Increased access to the river due to road development and increased river navigability has allowed people to invade the river and its backwaters, disrupting wildlife feeding and nesting activities. Conditions have been eased somewhat by the creation of three Federal refuges on the river (Imperial, Cibola, and Havasu), but damaging human impact is still widespread. Enhancement of backwater habitats for wildlife must be a consideration in future construction projects along the river. Following construction, access roads should be completely closed to public use to at least one-quarter mile and preferably one-half mile from the marshes. Future backwaters intended for wildlife should be constructed to contain gently sloping shorelines to support emergent vegetation, yet have deepwater areas to prevent high water temperatures in summer months. Some type of water exchange with the river is required to provide fresh and cool water inflow. Backwaters must be managed to prevent silt and organic accumulation which eventually reduces the general wildlife use value. Precision dredging or draglining appears to be the best method currently available. (Robinett-Arizona)
W76-06589

SOIL EROSION AND SEDIMENTATION IN TANZANIA AND LESOTHO.
Secretariat for International Ecology, (Sweden).
For primary bibliographic entry see Field 4D.
W76-06593

BLACK RIVER BAROMETER WATERSHED IN RELATION TO THE RESOURCE MANAGER.
Forest Service (USDA), Springville, Ariz. Apache-Sitgreaves National Forest.
For primary bibliographic entry see Field 4D.

W76-06599

HYDROLOGICAL FORECASTING PRACTICES.
World Meteorological Organization, Geneva (Switzerland). Working Group on Hydrological Forecasting.
For primary bibliographic entry see Field 2A.
W76-06633

STATE-OF-THE-ART SURVEY AND EVALUATION OF MARSH PLANT ESTABLISHMENT TECHNIQUES: INDUCED AND NATURAL; VOLUME I: REPORT OF RESEARCH.
Michigan Univ. Ann Arbor, School of Natural Resources.
J. A. Kadlec, and W. A. Wentz.
Available from the National Technical Information Service, Springfield, Va. 22161, AD-A012 834, \$9.00 in paper copy, \$2.25 in microfiche. Contract Report D-74-9, December 1974. 266 p, 5 fig, 8 tab, 419 ref, 4 append. Army DACW72-74-C-0010.

Descriptors: *Aquatic plants, *Marsh plants, *Marshes, Vegetation, Aquatic environment, *Marsh management, Reproduction, *Vegetation establishment, Freshwater, Saline water, Salinity, Temperature, Soils, Wetlands, Environment, *Reviews, *Bibliographies.

Knowledge of marsh and aquatic plant establishment was assessed by reviewing the literature and contacting agencies and individuals likely to have relevant information. Factors that affect plant establishment in saltwater areas include tides salinity, drainage, aeration, water table, rainfall, soil, evaporation, temperature, biota, water depth, light penetration, and current and wave action. In freshwater areas, water levels or depths, substrate, water quality, turbidity, currents and wave action are particularly important. Aquatic and marsh plants propagate naturally by both seeds and vegetative parts. The propagules are dispersed by wind, water, animals, and man. By controlling various environmental factors, it is possible to promote and encourage the natural invasion and growth of aquatic and marsh plants, especially in freshwater systems. In many cases, plantings of aquatic and marsh plants will be necessary to vegetate a new substrate. Seeding appears to be the least expensive procedure, but environmental condition must be favorable or success will be low. Transplants usually provide faster establishment and are harder than seedlings. Efforts at establishing *Spartina alterniflora* in Atlantic coast marshes have shown good results. The basic problems encountered in the establishment of aquatic and marsh plants are physically unsuitable substrates, nutrient deficiencies, polluted sediments, excessive wind or current action, excessive turbidity, unfavorable patterns of water level fluctuations, and unfavorable water depths. Research is needed in aquatic and marsh plant taxonomy, biology, and ecology. Special effort should be devoted to the study of site conditions and propagate collecting and planting methods. (See also W76-06636) (Sims-ISWS)
W76-06635

STATE-OF-THE-ART SURVEY AND EVALUATION OF MARSH PLANT ESTABLISHMENT TECHNIQUES: INDUCED AND NATURAL; VOLUME II: A SELECTED ANNOTATED BIBLIOGRAPHY ON AQUATIC AND MARSH PLANTS AND THEIR MANAGEMENT.
Michigan Univ., Ann Arbor, School of Natural Resources.
W. A. Wentz, R. L. Smith, and J. A. Kadlec.
Available from the National Technical Information Service, Springfield, Va. 22161, as AD-A012837, \$7.75 in paper copy, \$2.25 in microfiche. Contract Report D-74-9, December 1974. 206 p, 1 append. Army DACW72-74-C-0010.

WATER QUANTITY MANAGEMENT AND CONTROL—Field 4

Control Of Water On The Surface—Group 4A

Descriptors: *Aquatic plants, *Marsh plants, *Bibliographies, Abstracts, Information retrieval, Publications, Marshes, - Vegetation, Marsh management, Wetlands, Environment, *Reviews.

The 703 references listed in this volume were collected for the investigation of marsh and aquatic plant establishment which is reported in Volume I, Report of Research, of this report. The purpose of this bibliography is to make available an annotated listing of references which were not cited in Volume I. Although the bibliography does not represent an exhaustive review of the literature, it does provide an extensive survey of the pertinent references on the ecology and management of aquatic and marsh plants. The references selected for this bibliography emphasize studies useful to researchers and managers and concentrates on coastal, Great Lakes, and riverine marshes. (See also W76-06635) (Sims - ISWS)
W76-06636

SEASONAL STREAMFLOW ESTIMATION EMPLOYING SATELLITE SNOWCOVER OBSERVATIONS.

National Aeronautics and Space Administration, Greenbelt, Md. Goddard Space Flight Center. A. Rango, V. V. Salomonson, and J. L. Foster. Available from the National Technical Information Service, Springfield, Va. 22161 as N75-18695 \$5.00 in paper copy, \$2.25 in microfiche. Preprint X-913-75-26, February 1975. 34 p, 8 fig, 2 tab, 9 ref.

Descriptors: *Remote sensing, *Snow cover, *Streamflow forecasting, *Runoff, Snowmelt, Snowpacks, Melt water, Satellites(Artificial), Water supply, Snow surveys, Runoff forecasting, Data processing, Analytical techniques.
Identifiers: *LANDSAT.

Low resolution meteorological satellite and high resolution earth resources satellite data have been used to map snowcovered area over the upper Indus River and the Wind River Mountains of Wyoming, respectively. For the Indus River early Spring snowcovered area was extracted and related to April through June streamflow from 1967-1971 using a regression equation (coefficient of determination = 0.91). Prediction of the April-June 1972 streamflow from the satellite data was within 3% of the actual total. Composites results from two years of data over seven Wind River Mountain watersheds indicated that LANDSAT-1 snowcover observations, separated on the basis of watershed elevation, could also be related to runoff in significant regression equations. It appears that earth resources satellite data will be useful in assisting in the prediction of seasonal streamflow for various water resources applications, non-hazardous collection of snow data from restricted-access areas, and in hydrologic modeling of snowmelt runoff. (Sims - ISWS)
W76-06638

LAKE MANAGEMENT CONFERENCE, MAY 12-14, 1975.

Purdue Univ., Lafayette, Ind. Water Resources Research Center. Available from the National Technical Information Service, Springfield, Va. 22161, as PB-251 941, \$7.75 in paper copy, \$2.25 in microfiche. Proceedings of Conference sponsored by the Purdue University Water Resources Research Center. 206 p. (1975). D. Wiersma ed. OWRT A-999-IND(4).

Descriptors: *Lake Morphology, *Lake Fisheries, *Aquatic Weed control, *Herbicides, *Wetlands, *Fish management, Lakes, Lake basins, Limnology, Eutrophication, Recreation facilities, Indiana. Identifiers: *Lake renovation, Biologic weed control.

This is the proceedings of a two-day conference sponsored by the Purdue University Water

Resources Research Center. The program was developed for a lay audience interested in the maintenance and restoration of the natural lakes of Northeastern Indiana. It began with a discussion of the origin and general characteristics of Indiana lakes followed by presentations related to the role of government and local institutions as regulating agents. The second day dealt with some of the biological, physical and chemical means for restoring and maintaining lake quality. A panel discussion was held on the controversial issue of the phosphate ban in detergents. Panel members presented short papers after which there was a lively participation by the audience. (Wiersma-Purdue)
W76-06642

THE INFLUENCE OF FLOOD HAZARDS UPON RESIDENTIAL PROPERTY VALUES, Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Agricultural Economics. For primary bibliographic entry see Field 6F. W76-06643

A SOCIO-ECONOMIC EVALUATION OF ALTERNATIVE WATER MANAGEMENT POLICIES ON THE RIO GRANDE IN NEW MEXICO, New Mexico State Univ., University Park. Dept. of Agricultural Economics and Agricultural Business. For primary bibliographic entry see Field 6B. W76-06644

USE OF RADAR INFORMATION IN DETERMINING FLASH FLOOD POTENTIAL, National Weather Service, Garden City, N.Y. Eastern Region. E. Wasserman. NOAA TM NWS ER-60, December 1975. 10 p, 3 tab, 4 ref.

Descriptors: *Meteorology, Hydrology, *Precipitation(Atmospheric), *Flash floods, *Flood forecasting, Flood control, Warning systems, Rainfall intensity, Weather data, *Radar, Weather forecasting.
Identifiers: *Flash-flood potential, Flash flood guidance, MDR observations.

A systematic method is described in which manual digital radar values are used with flash flood guidance to help isolate areas where there is a flash flood potential. Radar estimates of maximum precipitation are compared objectively with the minimum, three-hour precipitation amounts required for flash flooding. Through this comparison, areas that have a potential for flash flooding are determined. Flash Flood Guidance is the minimum rainfall required for flash flooding. Using the three latest manually digitized radar (MDR) observations, a three-step procedure is presented for monitoring flash flood potential. A fourth step which requires detailed radar information, such as remote radar facsimile data, also is described. (NOAA)
W76-06653

LAKE HURON BEGINNING-OF-MONTH WATER LEVELS AND MONTHLY RATES OF CHANGE OF STORAGE,

National Oceanic and Atmospheric Administration, Boulder, Colo. Environmental Research Labs. For primary bibliographic entry see Field 2H. W76-06657

BUFFALO HARBOR DIKED DISPOSAL SITES: ENGINEERING PROPERTIES AND DRAINAGE CHARACTERISTICS, State Univ. of New York Coll. at Buffalo. For primary bibliographic entry see Field 5E. W76-06666

METHOD FOR REDUCING SINGLE DISCHARGE MEASUREMENTS TO THE AVERAGE DISCHARGE OF THE LOW-FLOW PERIOD, For primary bibliographic entry see Field 2E. W76-06679

CONTROLLING RESERVOIR TRAP EFFICIENCY, Agricultural Research Service, Columbia, Mo. North Central Watershed Center. For primary bibliographic entry see Field 8B. W76-06682

THE IMPACT OF OVERWINTER DRAWDOWN ON THE AQUATIC VEGETATION OF THE CHIPPEWA FLOWAGE, WISCONSIN, Wisconsin Univ., Madison. Environmental Resources Extension. S. A. Nichols. Wisconsin Academy of Sciences, Arts and Letters, Vol. 63, p. 176-186, 1975. 1 fig., 5 tab., 12 ref.

Descriptors: *Aquatic weed control, *Plant populations, *Drawdown, Water level fluctuations, Reservoirs, Winter, Wisconsin. Identifiers: Chippewa Flowage(Wis.).

The stabilization of aquatic plant species in response to 50 years of water level fluctuations in the Wisconsin Chippewa Flowage (a 6120 ha area of interconnected bays, lake basins, and flood river channels operated as a storage, flood control, and recreation reservoir) is indicated. The variety of plant species is now much greater and there is no significant decrease in diversity with increased drawdown and in fact some of the highest diversity occurs in areas that had the greatest amount of drawdown. Although the water levels, fluctuate drastically, most fluctuations do not occur during the growing season. Exposure of reproductive parts is not always detrimental and may even be beneficial or necessary for germination of certain species. *Clyceria borealis*, *Leersia orozoides*, *Polygonum natans*, *Salix interior*, *Scripus validus* and *Sium suave* all showed an increase under drawdown conditions, as these species can survive under both terrestrial and aquatic situations. *Asclepias incarnata*, *Brasenia schreberi*, *Elocharis acicularis*, *Nuphar variegatum*, *Nymphaea tuberosa*, *Potamogeton amplifolius*, *Potentilla palustris*, and *Sagittaria latifolia* showed a preference for stabilized water levels. *Najas flexilis*, *Potamogeton americanus*, *P. foliosus*, *P. gramineus* and *Anacharis canadensis* appear to be able to recover and actually can increase after repeated drawdowns. (Auen-Wisconsin).
W76-06711

IDENTIFICATION AND MANAGEMENT OF EURASIAN WATER MILFOIL IN WISCONSIN, Wisconsin Univ. Extension, Madison. Environmental Resources Unit. For primary bibliographic entry see Field 5C. W76-06725

WATER ECONOMY OF A SOIL ON WEATHERED GRANITE UNDER A SPRUCE GROVE, (IN FRENCH), Paris-7 Univ. (France). Lab. of Biogeography. For primary bibliographic entry see Field 2G. W76-06728

FLOODING AS THE RESULT OF HURRICANE AGNES, AND ITS EFFECT ON A MACROBENTHIC COMMUNITY IN AN INFERTILE HEADWATER STREAM IN CENTRAL PENNSYLVANIA, Pennsylvania Fish Commission, Bellefonte. Benner Spring Fisheries Research Station. For primary bibliographic entry see Field 5C. W76-06748

Field 4—WATER QUANTITY MANAGEMENT AND CONTROL

Group 4A—Control Of Water On The Surface

ECOLOGICAL EFFECTS OF WEATHER MODIFICATION: EFFECT OF LATE SNOW-MELT ON FESTUCA IDAHOENSIS ELMER MEADOWS.
Montana State Univ., Bozeman. Dept. of Biology.
For primary bibliographic entry see Field 3B.
W76-06756

THE EFFECT OF FOREST ON MINIMUM RIVER RUNOFF IN THE BROAD-LEAVED FOREST ZONE AND FOREST-STEPPE OF THE EUROPEAN PART OF THE USSR, (IN RUSSIAN).
For primary bibliographic entry see Field 4C.
W76-06783

OPTIMAL DISTRIBUTION OF ASSIMILATES DURING LIMITED WATER SUPPLY: A MATHEMATICAL MODE, (IN RUSSIAN).
Akademiya Nauk Estonskoi SSR, Tartu. Institut Fiziki i Astronomii.
For primary bibliographic entry see Field 2I.
W76-06786

EFFECTS OF ANTITRANSPIRANTS ON DISTRIBUTION AND UTILIZATION OF PHOTOSYNTHATE IN PINUS RESINOSA SEEDLINGS.
Ibadan Univ. (Nigeria). Dept. of Botany.
For primary bibliographic entry see Field 2I.
W76-06792

4B. Groundwater Management

KANSAS GROUNDWATER POLICY SEMINAR.
Kansas Water Resources Research Inst., Manhattan.
L. F. Keller.
Available from the National Technical Information Service, Springfield, Va. 22161, as PB-251 545, \$4.50 in paper copy, \$2.25 in microfiche. KWRRI Contribution No. 171, October 1975. 62p 2 fig, 4 append. OWR T A-064-Kan(1) 14-31-0001-5016.

Descriptors: *Groundwater mining, *Kansas, Decision making, Water policy, Future planning(Projected), Groundwater resources, Water supply, Water management(Applied), Conferences, Research priorities, Water utilization.
Identifiers: Applied research, Policymakers, Groundwater seminar, Future groundwater policies.

The project was a seminar designed on groundwater mining in Kansas. Policy makers and experts on water resources, both from within and outside the University, acted as research resources, project critics and reality checks for student research. Both policymakers and experts made presentations to particular sessions of the seminar and indicated future research topics on groundwater. Three topics are required: (1) the seminar and how well it worked; (2) Kansas groundwater policies and (3) future policy issues in groundwater mining.
W76-06154

SALINITIES OF AMBIENT AND INTERSTITIAL WATERS OF SOME MASSACHUSETTS NORTH SHORE SALT-MARSHES.
Massachusetts Univ., Amherst.
For primary bibliographic entry see Field 5B.
W76-06158

THE ROLE OF GROUNDWATER IN RURAL SUPPLIES IN GHANA.
Ghana Water and Sewerage Corp., Bolgatanga.
R. R. Bannerman.
Hydrological Sciences Bulletin, Vol. 20, No. 2, p. 191-201, June 1975. 4 fig, 2 tab, 9 ref.

Descriptors: *Groundwater, *Rural areas, *Africa, Population, Water supply, Hydrogeology, Water policy, Rocks, Boreholes, Unit costs, Dug wells, Pumps.
Identifiers: *Ghana, *Rural water supplies, Rural communities, *West Africa, Villages, Hand-pumps, Hand-pump operations.

Over 60% of the population of Ghana is described as rural and is projected to remain so up to the end of the century. Water supplies for these populations are generally unsafe and unreliable. Water-borne diseases are endemic. Concern has been expressed in government planning and development programs; and planners were required to study the groundwater potential of the country and to what use groundwater should be put to in a rural water supply program. Results of studies conducted showed that water supply schemes based on groundwater sources have a clear economic advantage over those based on surface water. Relatively shallow boreholes equipped with dependable hand-pumps have a cost advantage over deep boreholes with motorized pumps. With the rather limited funds allocated for meeting rural water supply needs economically, a hand-pumped borehole program has been recently initiated and is already making a great impact among the rural people. (Roberts - ISWS)
W76-06169

HOT SPRINGS OF RHODESIA: THEIR NOBLE GASES, ISOTOPIC AND CHEMICAL COMPOSITION.
University of the Witwatersrand, Johannesburg (South Africa). Nuclear Physics Research Unit.
For primary bibliographic entry see Field 2K.
W76-06190

PUBLIC GROUNDWATER SUPPLIES IN PUTNAM COUNTY.
Illinois State Water Survey, Urbana.
D. M. Woller, and E. W. Sanderson.
Available from the National Technical Information Service, Springfield, Va. 22161 as PB-251 550 \$3.50 in paper copy, \$2.25 in microfiche. ISWS Bulletin 60-18, 1976. 13 p, 2 fig, 1 tab.

Descriptors: *Water supply, *Illinois, *Groundwater resources, Well data, Unconsolidated aquifers, Gravels, Sand aquifers, Bedrock, Sandstones, Dolomite, Groundwater availability, Groundwater, Hydrology, Hydrogeology, Water sources, Water quality, Water wells, Municipal water, Water yield, Water properties, Hardness(Water), Chemical properties, Deep wells, Shallow wells, Geology, Aquifers.
Identifiers: *Putnam County(III), Dissolved minerals, Water bearing formations.

All available information was presented on production wells used for public groundwater supplies in Putnam County, Illinois. The definition of public water supply as contained in the Environmental Protection Act of 1970 was used to determine those water systems and wells to be included. Unconsolidated sand and gravel deposits associated with the Illinois River valley and the ancient Mississippi valley are tapped as a source of public water supply. There are 7 supply wells finished in these aquifers at depths of 100 to 237 ft. Reported yields range from 15 to 780 gpm. Analyses of water from these wells indicated that the iron content ranges from 0.0 to 7.6 mg/l, and the hardness from 296 to 379 mg/l. One well penetrates the Pennsylvanian rocks. It is 320 ft deep and is pumped at a rate of 15 gpm. A recent analysis of water from this well indicated the iron content is 0.42 mg/l and the hardness is 326 mg/l. The deep-lying Galena-Platteville Dolomite and Glenwood-St. Peter Sandstone are also tapped as a source of public water supply. Three wells in use range in depth from 1741.6 to 1793 ft. They are pumped at rates of about 60 to 150 gpm. Analyses of water from these wells show the iron content

ranges from 0.1 to 3.8 mg/l, chlorides from 240 to 3690 mg/l, sodium from 245 to 2550 mg/l, hardness from 219 to 238 mg/l, and total dissolved minerals from 975 to 6333 mg/l. Individual production wells for each supply were described in the order of their construction. The description for each well includes the aquifer or aquifers tapped, date drilled, depth, driller, legal location, elevation in feet above mean sea level, log, construction features, yield, pumping equipment, and chemical analyses. (Humphreys - ISWS)
W76-06237

CONVERSION OF DESALINATION PLANT BRINES TO SOLIDS.
Badger (W. L.) Associates, Inc., Ann Arbor, Mich.
For primary bibliographic entry see Field 3A.
W76-06248

PUBLIC GROUNDWATER SUPPLIES IN MACOUPIN COUNTY.
Illinois State Water Survey, Urbana.
D. M. Woller.
Available from the National Technical Information Service, Springfield, Va., 22161, as PB-251 674 \$3.50 in paper copy, \$2.25 in microfiche. ISWS Bulletin 60-17, 1976. 9 p, 1 fig.

Descriptors: *Water supply, *Illinois, *Groundwater resources, *Well data, Unconsolidated aquifers, Gravels, Sand aquifers, Groundwater, Groundwater availability, Hydrology, Hydrogeology, Water sources, Water quality, Water wells, Municipal water, Water yield, Water properties, Hardness(Water), Chemical properties, Shallow wells, Geology.
Identifiers: *Macoupin County(III), Dissolved minerals, Water bearing formations.

All available information was reported on production wells used for public groundwater supplies in Macoupin County, Illinois. The definition of public water supply as contained in the Environmental Protection Act of 1970 was used to determine those water systems and wells to be included. Sand and gravel deposits in the unconsolidated materials above bedrock are tapped as the sources for three public water supplies. There are presently five public supply production wells, ranging in depth from 34 to 54 ft. Their reported yields range from 15 to 150 gpm. Past and present analyses of water from the three groundwater supplies indicated that the iron content ranges from 3.1 to 19 mg/l, and the hardness from 176 to 580 mg/l. Individual production wells for each supply were described in the order of their construction. A description for each well includes the aquifer tapped, date drilled, depth, driller, legal location, elevation in feet above mean sea level, log, construction features, yield, pumping equipment, and chemical analyses. (Humphreys-ISWS)
W76-06257

PLANNING A MUST FOR GROUNDWATER DEVELOPMENT.
Clinton Bogert Associates, Fort Lee, N.J.
J. J. Baffa.
Water and Wastes Engineering, Vol. 12, No. 2, p. 44-50, Feb., 1975. 3 fig.

Descriptors: *Aquifers, Groundwater, *Groundwater recharge, *Groundwater potential, *Artificial recharge, *Natural recharge, Water resources, Injection wells, Boundaries, Water quality, Land use, Borehole geophysics, Maryland, Oklahoma, New York.
Identifiers: *Long Island(NY), *Riverhead(NY).

Careful analysis is needed in groundwater aquifer development. Quantity of groundwater available is related to aquifer extent and properties, recharge characteristics, natural discharge, artificial recharge possibilities, drought occurrence, and withdrawals already being made. Quality is related to the naturally occurring relationships of solubili-

ty and ion exchange of soil rocks. Geophysical methods and bore holes can suggest location of aquifers. Resistivity methods can be used to locate groundwater boundaries such as faults and dykes. Induced recharge can be accomplished by creating a reservoir in a natural streambed located in a recharge area. Rates of .1 to .4 feet per day have been reported for this type of recharge depending on local conditions. Artificial recharge of special recharge basins or wells is from diversion of stream flow from peak discharge periods or of storm water. Recharge rates of 30 feet per day and occasionally as high as 100 feet per day have been recorded. Injection wells operate in the range of 50 to 3000 gallons per minute. In designing groundwater supply, account must be taken of the effects of urban and agricultural land use, sanitary landfills, dissolved solids present, biological activity and the possibility of purifying water before recharge. It is good practice to undertake pilot projects before undertaking large scale facilities; well performance, well levels, hydrodynamic dispersion of recharge waters, and water quality effects may be measured in order to estimate recharge potential. (Smith - North Carolina)
W76-06273

HYDROLOGICAL AND HYDROGEOLOGICAL ASSESSMENT OF LANDFILL SITES,
For primary bibliographic entry see Field 5E.
W76-06315

GROUND-WATER QUALITY IN SELECTED AREAS SERVICED BY SEPTIC TANKS, DADE COUNTY, FLORIDA,
Geological Survey, Tallahassee, Fla.
For primary bibliographic entry see Field 5B.
W76-06442

THE LOWER WILCOX AQUIFER IN MISSISSIPPI,
Geological Survey, Jackson, Miss.
For primary bibliographic entry see Field 7C.
W76-06444

THE MIOCENE AQUIFER SYSTEM IN MISSISSIPPI,
Geological Survey, Jackson, Miss.
For primary bibliographic entry see Field 7C.
W76-06445

HYDROLOGIC DATA FOR THE IDAHO NATIONAL ENGINEERING LABORATORY SITE, IDAHO, 1971 TO 1973,
Geological Survey, Idaho Falls, Idaho.
For primary bibliographic entry see Field 5B.
W76-06447

WATER RESOURCES OF THE THRUST BELT OF WESTERN WYOMING,
Geological Survey, Cheyenne, Wyo.
For primary bibliographic entry see Field 7C.
W76-06448

FACTORS ALTERING THE MICROCLIMATE IN CARLSBAD CAVERNS, NEW MEXICO,
Geological Survey, Albuquerque, N. Mex.
For primary bibliographic entry see Field 2D.
W76-06452

HYDROLOGIC EVALUATION OF SALINITY CONTROL AND RECLAMATION PROJECTS IN THE INDUS PLAIN, PAKISTAN--A SUMMARY,
Geological Survey, Reston, Va.
For primary bibliographic entry see Field 5G.
W76-06453

BIBLIOGRAPHY OF STUDIES ON THE DENSITY AND OTHER VOLUMETRIC PROPERTIES FOR MAJOR COMPONENTS IN GEOTHERMAL WATERS, 1928-1974,
Geological Survey, Menlo Park, Calif.
R. W. Potter, D. R. Shaw, and J. L. Haas, Jr.
Open-file report 75-147, 1975. 78 p.

Descriptors: *Geothermal studies, *Bibliographies, *Reviews, *Publications, *Thermal water, Properties, Chemical properties, Salts, Density, Natural resources, Energy, Information retrieval.

This bibliography is an annotated listing of 230 references pertaining to the density of solutions of importance to geothermal exploration and energy production. The scope of this report has been restricted to reference containing data on aqueous solutions of the following salts: HCl, NaCl, KCl, CaCl₂, FeCl₂, H₂SO₄, NaHSO₄, Na₂SO₄, KHSO₄, K₂SO₄, FeSO₄, H₂CO₃, NaHCO₃, Na₂CO₃, KHC03, K₂CO₃, NaOH, KOH, SiO₂(ag), 'sea water'. The bibliography is a first step toward satisfying the needs of scientists and engineers as were expressed at the Conference on Thermodynamics and National Energy Problems and as further amplified by an ad hoc committee of scientists convened by the U.S. Atomic Energy Commission. Support for this work has come from the U. S. Geological Survey's geothermal research program. (Woodard-USGS)
W76-06454

AQUEOUS SOLUBILITY OF PETROLEUM AS APPLIED TO ITS ORIGIN AND PRIMARY MIGRATION,
Geological Survey, Denver, Colo. Office of Energy Resources.
L. C. Price.
American Association of Petroleum Geologists Bulletin, Vol 60, No 2, p 213-244, February 1976. 19 fig, 9 tab, 175 ref.

Descriptors: *Solubility, *Oil, *Aqueous solutions, *Groundwater, *Temperature, Depth, Aquifers, Thermal water, Chemical reactions, Salinity, Vertical migration, Oil industry, Organic compounds.
Identifiers: *Petroleum.

The aqueous solubilities of individual hydrocarbons, petroleum, and petroleum fractions increase with increasing temperatures as determined by solubility data gathered in this study. The rate of solubility increase is uniform from room temperature to about 100 deg C where it increases drastically. At temperatures in excess of 180 deg C petroleum solubilities in water are high enough to account for the formation of petroleum deposits by a molecular-solution primary-migration mechanism. For example, the aqueous solubility of the gas-oil fraction (boiling range 316-371 deg C of the Ghawar Arabian crude oil shows over a 400-fold increase from 25 deg C to 180 deg C from 0.042 ppm to 17.0 ppm. The pronounced decrease in solubility of petroleum at the lower temperatures at shallow lower basin depths and from the movement of fresh shale waters into salty sand waters both readily serve to release dissolved hydrocarbons during the upward movement of deep basinal waters. Other investigators have shown that 15-20 percent water, by volume, remains in the clastic sediments at depths below 4.27-5.49 km in the Gulf Coast and other basins. This quantity of water as shown by mass-balance calculations is sufficient to account for the primary migration of petroleum from source rocks by molecular solution. Faults are believed to provide the main pathway for the vertical movement of water and dissolved hydrocarbons from great basinal depths. (Woodard-USGS)
W76-06455

SOUTHEASTERN MICHIGAN WATER-RESOURCES STUDY: GROUND WATER AND GEOLOGY,
Geological Survey, Lansing, Mich.
F. R. Twenter.
Geological Survey Data report, 1975. 143 p, 31 fig, 36 tab, 46 ref.

Descriptors: *Groundwater resources, *Aquifer characteristics, *Water quality, *Hydrogeology, *Michigan, Data collections, Water supply, Water demand, Water utilization, Water yield, River basins.
Identifiers: Southeastern Michigan.

Southeastern Michigan, an area of 5,407 sq mi, encompasses all or parts of 13 counties and is drained by 7 major streams. About half of the State's population reside in the area. The land surface ranges in altitude from about 570 ft to about 1,200 ft. Precipitation ranges from 28 to 34 in annually. The average stream discharge in the area is about 2,300 cfs. Both bedrock and glacial deposits yield water to wells in the study area. Aquifers of both rock types underlie parts of the area. Of the bedrock formations that are tapped, the Saginaw Formation, Marshall Formation, Berea Sandstone, Sylvania Sandstone, and Bass Islands Dolomite generally yield the greatest quantities of water--in some places as much as 300 gpm. In the glacial deposits, sand and gravel, often occurring as outwash, are the principal water-producing rocks. In some places as much as 3,000 gpm can be obtained from these rocks. In both bedrock and glacial deposits the concentration of dissolved solids increases as the well depth increases. Many deeper wells yield water that is too highly mineralized for most uses. (Woodard-USGS)
W76-06457

PROGRESS REPORT ON THE WATER RESOURCES INVESTIGATION OF MARTIN COUNTY, FLORIDA,
Geological Survey, Tallahassee, Fla.
J. E. Earle.
Open-file report FL 75-521, 1975. 20 p, 10 fig, 1 tab, 6 ref.

Descriptors: *Water resources, *Data collections, *Water quality, *Florida, Groundwater, Surface waters, Aquifer characteristics, Water level fluctuations, Withdrawal, Water supply, Municipal water, Observation wells, Salinity, Streams, Nitrogen, Phosphorus.
Identifiers: *Martin County(Fla).

The base of the shallow aquifer ranges from 125 feet below sea level in the northwest part of Martin County, Fla., to about 280 feet below sea level in the southeast part of the county. Water levels decline about 2 to 5 feet during the dry season (October 1973 to May 1974) in most areas of Martin County. Within the area influenced by the pumping of Stuart's public supply wells, water level declined 6 feet between October 1973 and May 1974. Water levels during January - May 1974 in this area were 3 to 6 feet lower than they were in January - May 1965. This difference was due to a three-fold increase in pumpage (0.8 to 2 mgd) from 1965 to 1974. Chloride concentrations in four salt water monitoring wells around the Stuart well field ranged from 35 to 45 mg/litre during the rainy season of 1973. No appreciative increase in chlorides was found by the end of the next dry season. Water from five surface water sites had higher concentrations of phosphorus than water found in a typical urban area in Fort Lauderdale. Water from seven sites contained concentrations of nitrogen less than the typical rural site average. (Woodard-USGS)
W76-06459

GROUND-WATER IN NEW MEXICO, 1973,
Geological Survey, Albuquerque, N. Mex.
For primary bibliographic entry see Field 7C.
W76-06460

Field 4—WATER QUANTITY MANAGEMENT AND CONTROL

Group 4B—Groundwater Management

SYSTEMATIC DESIGN OF LEGAL REGULATIONS FOR OPTIMAL SURFACE-GROUND-WATER USAGE - PHASE 2.

Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
H. J. Morel-Seytoux, R. A. Young, and G. E. Radosevich.

Available from the National Technical Information Service, Springfield, Va 22161 as PB-251 889, \$8.00 in paper copy, \$2.25 in microfiche. Environmental Resources Center, Colorado State University, Fort Collins, Completion Report Series No. 68, September 1975, 229 p. OWRT B-109-COLO(5) 14-31-0001-4067

Descriptors: Groundwater, *Surface-groundwater relationships, Regulation, Pumping, Optimization, Design, *Conjunctive use, Water law, Legal aspects, Water management(Applied), Aquifers, Computer programs, *Model studies, Water wells, Arid lands, Seepage.

Identifiers: *Groundwater management, Conjunctive operations.

The design of regulations for integrated management of surface and groundwater is a complex and crucial problem in regions of the United States with a dry climate and a paucity of water resources. Analysis of the problem indicated the need to develop a new approach to hydrologic modeling of the interactions between a stream and an alluvial aquifer. This new approach conveniently provides the aquifer response to pumping from wells, the aquifer response to seepage flow from the river and the river response to pumping from wells. Several computer programs, operating sequentially, have been developed. Tests of the programs reported here, show that the developed technique provides comparable accuracy to more standard approaches. The benefits of the new approach are realized when the hydrologic model is coupled with an economic objective and with legal constraints. Several computer programs were developed. One of these computer programs (the most important and complex one) is fully documented in this report. Illustrative applications of these programs to solution of management problems involving legal constraints and economic considerations are provided. (See also W74-04853).

W76-06551

GROUNDWATER RESOURCES OF ALTUN-KUPRI AREA.

Institute for Applied Research on Natural Resources, Baghdad (Iraq).
R. H. Haddad, P. B. Smoor, D. Y. Basheo, S. K. Sarbaro, and J. J. Dunnat.
Technical Bulletin 69, September, 1974. 115 p, 37 fig, 7 tab, 17 ref, 2 append.

Descriptors: *Groundwater resources, *Aquifer characteristics, *Transmissivity, *Storage coefficient, *Safe yield, Aquifer systems, Groundwater, Hydrogeology, Water sources, Water supply, Natural recharge, Groundwater recharge, Water resources development, Alluvium.

Identifiers: *Altun-Kupri(Iraq).

The Altun-Kupri area located in northern Iraq covers about 860 square kilometers and has large potential groundwater resources which have only been partially developed. The upper part of the aquifer system, which is the main area of present and potential development, consists of Pleistocene and recent alluvial deposits underlain by Bakhtiari formation. Recharge generally takes place in the upland outcrop area of the Bakhtiari formation and the principal zone of discharge is in the vicinity of the mouth of the Jolak Wadi. Average transmissivity of the upper part of the aquifer system was estimated at about 2200 sq m/day, and because of the generally unconfined to semi-confined nature of the aquifer, a storage coefficient of 0.1 was assumed. Recharge to the entire basin for 1973-74, based on water level fluctuations and flow net analysis, was about 84,000,000 cubic me-

ters per year. If pumping is confined to the upper part of the aquifer system, about 36 to 68 million cubic meters per year may be available for groundwater development from both temporary and permanent storage, assuming perfect completion and distribution of wells and certain critical limits for the drawdowns permitted. (Robinett-Arizona)
W76-06576

HIDDEN WATERS IN ARID LANDS.

Report of a Workshop on Groundwater Research Needs in Arid and Semi-Arid Zones, November 25, 1974, Paris, France, International Development Research Centre, Ottawa, Canada, 1975. 18 p. 2 append. L. A. Heindl, ed.

Descriptors: *Groundwater, *Arid lands, *Water resources development, *Water supply, *Droughts, Groundwater resources, Water quality, Semiarid climates, Water shortage, Environmental effects, Social aspects, Hydrogeology, Hydrologic data, Water management(Applied).

Because arid and semi-arid zones encompass about one-fifth of the earth's surface, increasing numbers of people continue to expand the use of these regions for food production and living space. The shortage of water can be eased in many regions by use of the huge reserves of groundwater stored in confined aquifers underlying these areas, but in many regions the amount and quality available are unknown. The Association of Geoscientists for International Development attempts in this workshop to single out specific research needs by presenting country reports, in an informal setting, that deal with the sources and quality of groundwater, the environmental and cultural impact of development, and coping with drought. Recommendations call for (1) exchange of information and encouragement of research, (2) immediate attention to an array of eight specific areas of applied research, (3) prompt attention to provision for trained hydrogeologists and hydrological engineers in critical areas, (4) managerial practices in the field of water development, (5) preparation of inventories of regional groundwater resources, and (6) collection of information on local droughts by hydrogeologists. (Robinett-Arizona)
W76-06585

COSTS ARE SOARING: IRRIGATING FROM THE UNDERGROUND.

Arizona Univ. Tucson. Dept. of Agricultural Economics.
For primary bibliographic entry see Field 3F.
W76-06586

FINITE STATE MIXING-CELL MODELS.

Arizona Univ., Tucson. Dept. of Hydrology and Water Resources.
For primary bibliographic entry see Field 2F.
W76-06594

UNCERTAINTIES IN KARSTIC WATER RESOURCES SYSTEMS.

Arizona Univ., Tucson. Dept. of Systems and Industrial Engineering.
For primary bibliographic entry see Field 2F.
W76-06595

A SOCIO-ECONOMIC EVALUATION OF ALTERNATIVE WATER MANAGEMENT POLICIES ON THE RIO GRANDE IN NEW MEXICO.

New Mexico State Univ., University Park. Dept. of Agricultural Economics and Agricultural Business.
For primary bibliographic entry see Field 6B.
W76-06644

WATER POLLUTION ABATEMENT THROUGH FOREST IRRIGATION WITH MUNICIPAL WASTE WATER.

Pennsylvania State Univ., University Park. Inst. for Research on Land and Water Resources.
For primary bibliographic entry see Field 5D.
W76-06668

WEATHERING AND HYDROGEOLOGY OF THE BRUMUNDDAL SANDSTONE, SOUTHERN NORWAY.

Norges Landbrukshoegskole, Vollebakk. Geologisk Institutt.
For primary bibliographic entry see Field 2F.
W76-06676

MONITORING GROUND-WATER QUALITY NEAR A SANITARY LANDFILL.

Earthview, Incorporated, Toledo, Ohio.
For primary bibliographic entry see Field 5A.
W76-06684

RAPID RECHARGE IN A LIMESTONE AQUIFER.

Birmingham Univ., (England). Dept. of Civil Engineering.
For primary bibliographic entry see Field 2F.
W76-06685

FIBONACCI SEARCH FOR HIGH-YIELD WELL SITES.

California Univ., Davis. Dept. of Civil Engineering.
O. J. Helweg.
Ground Water, Vol. 14, No. 2, p78-81, March-April 1976. 6 fig, 1 tab, 2 ref.

Descriptors: *Operations research, *Drilling, *Test wells, *Optimization, Aquifers, Bedrock, Mathematical studies, Statistical methods, Cost comparisons, Channels, Risks, Boundaries(Surfaces), Exploration.
Identifiers: *Fibonacci search, *Minimization techniques, Buried bedrock valleys, Pascal's triangle, Symmetry.

In areas where the bedrock is irregular, depressions in the bedrock formation can yield significantly higher amounts of water because the aquifer has a greater saturated thickness. Finding these areas by drilling test holes is a common practice but one that can be conducted more economically if an efficient search procedure is utilized. This paper described such a technique called the Fibonacci Search and showed that it can save thousands of dollars in the cost of drilling test holes when compared to 'brute-force' methods. (Visocky-ISWS)
W76-06686

PUMPING TEST ANALYSIS WHEN PARAMETERS VARY WITH DEPTH.

Birmingham Univ., (England). Dept. of Civil Engineering.
K. R. Rushton, and Y. K. Chan.
Ground Water, Vol. 14, No. 2, p 82-87, March-April 1976. 5 fig, 4 ref.

Descriptors: *Aquifer testing, *Data processing, *Depth, *Numerical analysis, Computer models, Permeability, Storage coefficient, Aquifer characteristics, Test wells, Limestones, Fissures(Geologic), Fracture permeability, Pumping, Drawdown, Observation wells.
Identifiers: *England, *Vertical flow components, *Discrete-space discrete-time technique, Parabolas.

The analysis of pumping tests for the same borehole but with different rest water levels may lead to significantly different values of aquifer parameters. A numerical method of pumping-test analysis was introduced in which the permeability

and storage coefficient can take different values depending on the current saturated depth. By introducing varying values of permeability and storage coefficient, the numerical model was used to represent pumping tests in a soft limestone aquifer. (Visocky-ISWS)
W76-06687

NITRATES IN KANSAS GROUNDWATERS AS RELATED TO ANIMAL AND HUMAN HEALTH.
Kansas State Univ., Manhattan. Comparative Toxicology Lab.
For primary bibliographic entry see Field 5B.
W76-06754

4C. Effects On Water Of Man's Non-Water Activities

PREVENTION AND CONTROL OF CULVERT ICING, SUMMARY REPORT ON STUDIES FY 1966-70.
Cold Regions Research and Engineering Lab., Hanover, N. H. Experimental Engineering Div.
For primary bibliographic entry see Field 8A.
W76-06193

THE ROLE AND FUNCTION OF VERDURE IN PROTECTING THE HUMAN ENVIRONMENT.
Polskie Towarzystwo Przyrodników im. Kopernika, Warsaw.
M. Wojcierska.
Wszechswiat. 4. 96-98. 1973.

Descriptors: Industrialization, Urbanization, *Environmental effects, *Vegetation effects, Environmental control, Pollutants, Pollution abatement, *Air pollution, *Soil contamination, *Water pollution.
Identifiers: Verdure, Tree belts, Forest belts.

The results of soil, water and air pollution from industrialization and urbanization are listed. Protective measures are suggested, and establishment of protective belts of verdure is recommended. Studies were carried out on the filtering action of plant cover. The level of air pollution under crowns of trees declined by 20-40% during the period of full vegetation, and by 13-18% during the period of leaflessness as compared to treeless areas. Suggestions are given on how tree belts should be planted in industrialized areas and in urban centers in order to be most effective as air filters. -Copyright 1975, Biological Abstracts, Inc.
W76-06240

COAL MINE SPOIL AS A GROWING MEDIUM: AMAX BELLE AYE SOUTH MINE, GILLETTE, WYOMING.
Forest Service (USDA), Fort Collins, Colo. Rocky Mountain Forest and Range Experiment Station.
For primary bibliographic entry see Field 5G.
W76-06364

THE EFFECT OF LAND USE ON THE CHEMICAL AND PHYSICAL QUALITY OF SURFACE AND GROUND WATERS IN SMALL WATER SHEDS.
Massachusetts Univ., Amherst. Dept. of Plant and Soil Sciences.
For primary bibliographic entry see Field 5B.
W76-06552

THE GREEN BAY WATERSHED - PAST/PRESENT/FUTURE.
Wisconsin Univ., Madison Inst. for Environmental Studies.
For primary bibliographic entry see Field 5C.
W76-06569

KANECHOCHE ALTERNATIVES: AN APPLICATION OF IMPACT METHODOLOGY.
Hawaii Environmental Simulation Lab., Honolulu.
For primary bibliographic entry see Field 6G.
W76-06574

THE RATIONALE OF NOMAD ECONOMY.
Uppsala Univ. (Sweden).
C. G. Widstrand.
Ambio, Vol. 4, No. 4, p 146-153, 1975. 3 fig, 12 ref.

Descriptors: *Livestock, Carrying capacity, Environmental effects, *Grazing, *Droughts, *Economics, Water shortage, Disasters, Migration.
Identifiers: *Nomads, Desertification.

Livestock herding peoples in west and east Africa have been severely hit lately by drought conditions. The disaster situation has been used as a means to change the life of these peoples. The survival of such peoples depends on a precise manipulation of the ecology, rational decision making, and risk management. However factors outside their control (water development, veterinary services, the creation of new international boundaries) have contributed heavily to the overstocking problem. (Robinet-Arizona)
W76-06591

DESERTIFICATION: A WORLD PROBLEM.
Worldwatch Inst., Washington, D.C.
E. P. Eckholm.
Ambio, Vol. 4, No. 4, p 137-145, 1975. 3 fig, 20 ref.

Descriptors: *Deserts, Grazing, Ecology, *Environmental effects, *Arid lands, Crop production, *Droughts, *Boundary processes, Burning, Productivity, Population, Accelerated erosion, Frail lands, Soil-water-plant relationships.
Identifiers: *Desertification, Sahelian zone.

Overgrazing and overly intensive cropping encourage the spread of deserts in Africa, Asia, and Latin America, and undermine the productivity of vast semiarid zones throughout the world. The evidence of desert encroachment worldwide is surveyed, and the implications of recent climatic change theories are discussed. Directions for the ecologically sustainable exploitation of arid lands are outlined. (Robinet-Arizona)
W76-06592

MANAGING CHAPARRAL FOR WATER AND OTHER RESOURCES IN ARIZONA.
Forest Service (USDA), Tempe, Ariz. Rocky Mountain Forest and Range Experiment Station.
For primary bibliographic entry see Field 3B.
W76-06597

VEGETATION MANAGEMENT FOR WATER AND RANGE IMPROVEMENT.
Arizona Univ., Tucson. School of Renewable Natural Resources.
For primary bibliographic entry see Field 3B.
W76-06598

STABILIZATION OF CLAY SOILS AGAINST EROSION LOSS.
Purdue Univ., Lafayette, Ind. School of Civil Engineering.
For primary bibliographic entry see Field 4D.
W76-06640

URBAN EFFECTS ON THE DISTRIBUTION OF HEAVY CONVECTIVE RAINFALL.
Illinois State Water Survey, Urbana.
F. A. Huff.
Water Resources Research, Vol. 11, No. 6, p 889-896, December 1975. 5 fig, 6 tab, 9 ref. NSF GI-38317.

Descriptors: *Rainfall, *Convection, *Rainfall disposition, *Central U.S., *Urbanization, Industries, Rainfall intensity, Weather modification, Floods, Water yield, Hydrology, Meteorology, Hydrologic aspects, Flood control, Rain gages, Sewers, Rural areas, Storms, Frequency.
Identifiers: Raincells, *Urban areas, Rainstorms, St. Louis(Mo), Alton(Ill), Wood River(Ill), Duration, Metromex, Sewer design.

Data from a network of 225 recording rain gages in 5500 sq km in the St. Louis area, operated during the summers of 1971-1973, were used to investigate potential urban effects upon the distribution of heavy rainfalls. Emphasis was placed upon analysis of: (1) rain cells, the basic convective unit responsible for the production of heavy short-duration rates in thunderstorm-dominated climates; and (2) the distribution of heavy rainstorms producing 25 mm or more of rainfall within the network. Results showed a substantially greater water yield from the urban-affected cells compared with that from the rural (control) cells. The excess was greatest in moderate to heavy storms and apparently resulted most often from enhancement of the natural atmospheric rainfall processes in organized weather systems. The 25-mm rainstorms showed a pronounced maximum of occurrence in a region that frequently lies downwind of two urban-industrial areas, St. Louis and Alton-Wood River. It was concluded that the frequency distribution of heavy rainfalls may vary significantly between urban, suburban, and rural areas in large urban-industrial regions and that this may necessitate reevaluation of sewer design storm parameters in current use. (Jones-ISWS)
W76-06680

THE EFFECT OF FOREST ON MINIMUM RIVER RUNOFF IN THE BROAD-LEAVED FOREST ZONE AND FOREST-STEPPE OF THE EUROPEAN PART OF THE USSR, (IN RUSSIAN).
G. S. Pimenova.
Lesove Denie 2, p 3-10, 1975.

Descriptors: *Runoff, Rivers, Europe, Forests, *Forest management, Grasslands, Soil moisture.
Identifiers: *USSR.

Data on the minimum runoff of small rivers in the broad-leaved zone and the forest-steppe from comparison of river basins with contrasting degrees of afforestation show that large tracts of forest are of great importance in increasing the underground water supply. In the central part of the forest-steppe, minimum river runoff in basins with greater afforestation is almost equal. The prevalence of an unsaturated soil moisture regime in the South is noted. -Copyright 1975, Biological Abstracts, Inc.
W76-06783

4D. Watershed Protection

FORMATION OF WATER AND SEDIMENT DISCHARGE DURING THE SPRING FLOOD ON A SLOPE AND IN A SMALL GULLY-RAVINE DRAINAGE BASIN.
For primary bibliographic entry see Field 2J.
W76-06176

SEDIMENT RESERVOIRS IN THE CHANNELS OF SMALL MOUNTAIN RIVERS.
For primary bibliographic entry see Field 2J.
W76-06177

SUBARCTIC PLANT COMMUNITIES AND ASSOCIATED LITTER AND SOIL PROFILES IN THE CARIBOU CREEK RESEARCH WATERSHED, INTERIOR ALASKA.
Cold Regions Research and Engineering Lab., Fairbanks, Alaska.
J. L. Troth, F. J. Deneke, and L. M. Brown.

Field 4—WATER QUANTITY MANAGEMENT AND CONTROL

Group 4D—Watershed Protection

Available from the National Technical Information Service, Springfield, Va 22161, as ADA-009 063, \$4.00 in paper copy, \$2.25 in microfiche. Research Report 330, March 1975. 25 p, 3 fig, 8 tab, 25 ref, 4 append.

Descriptors: *Watersheds(Basins), *Vegetation, *Soil chemistry, *Alaska, Forests, Trees, Plant populations, Cold regions, Soil chemical properties, Humus, Organic matter, Ecology, Hydrology, Soil profiles.
Identifiers: *Caribou Creek watershed(Alas).

Studies were completed in several black spruce and aspen/birch communities of the Caribou Creek Watershed. Frequency and basal area or percent cover were detailed for tree, sapling, shrub, herbaceous, moss, and lichen species. Organic layer mass was greatest beneath a north slope black spruce community. Carbon and nitrogen levels were higher in litter layers beneath the hardwood stands, whereas carbon/nitrogen ratios were higher in the living and decaying organic mat beneath black spruce. Concentrations of P, Ca, Mg, Mn and Zn were higher in hardwood than in conifer organic layers. K and Fe concentrations in organic layers were similar beneath hardwoods and conifers. Soils beneath conifer and hardwood stands could not be separated on the basis of pH, %C, %N, or C/N ratios. Cation exchange capacity closely reflected %C in all soils. More exchangeable bases were present in soils beneath hardwood communities than beneath black spruce communities. Increases in extractable P were found near the soil surface in aspen-dominated communities. Extractable soil P increased below 15 cm in conifer stands. (Sims - ISWS)

W76-06194

MORE WATER FOR ARIZONA.

Arizona Water Resources Committee, Phoenix; and Arizona Water Commission, Phoenix.
For primary bibliographic entry see Field 3B.
W76-06261

THE WATERSHED APPROACH TO UNDERSTANDING OUR ENVIRONMENT, Agricultural Research Service, Fort Collins, Colo.
For primary bibliographic entry see Field 5G.
W76-06311

MINE SPOIL RECLAMATION RESEARCH AT THE BELLE AYE MINE, NORTHEAST WYOMING, Forest Service (USDA), Fort Collins, Colo. Rocky Mountain Forest and Range Experiment Station.
For primary bibliographic entry see Field 5G.
W76-06361

RECOVERY FROM SOIL COMPACTION ON BLUEGRASS RANGE IN THE BLACK HILLS, Forest Service (USDA), Fort Collins, Colo. Rocky Mountain Forest and Range Experiment Station.
H. K. Orr.
Transaction of the ASAE, (American Society of Agricultural Engineers) Vol. 18 No. 6: p 1076-1081, 1975. 10 fig, 4 tab, 10 ref.

Descriptors: *Soil compaction, *Soil physical properties, Grazing, Grasslands, Surface runoff, Range management, *South Dakota.
Identifiers: *Black Hills, *Bluegrass bottoms, Livestock trampling, Soil recovery, Range hydrology.

Not until the second year after fencing did soils on heavily grazed bluegrass range show significantly more macro-pore volume and/or reduced bulk density. Under protection the infiltration capacities also increased and summer storm runoff decreased. More than one year of protection from trampling is needed for significant recovery from soil compaction, a matter of considerable importance in grazing management. (Forest Service)

W76-06362

TREND SURFACE ANALYSIS OF POWDER RIVER BASIN, WYOMING - MONTANA, Forest Service (USDA), Fort Collins, Colo. Rocky Mountain Forest and Range Experiment Station.
For primary bibliographic entry see Field 4A.
W76-06363

SEDIMENT DATA, CANADIAN RIVERS 1972. Department of the Environment, Ottawa (Ontario). Applied Hydrology Div.
For primary bibliographic entry see Field 7C.
W76-06376

A MODEL TO PREDICT THE PERFORMANCE OF FEEDLOT RUNOFF CONTROL FACILITIES AT SPECIFIC OREGON LOCATIONS, Oregon State Univ., Corvallis. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 5B.
W76-06382

COMPUTING PHREATIC GROUNDWATER STORAGE, Agricultural Research Service, Tifton, Ga.
For primary bibliographic entry see Field 2F.
W76-06409

RAINFALL-RUNOFF DATA FROM SMALL WATERSHEDS IN COLORADO, OCTOBER 1971 THROUGH SEPTEMBER 1974, Geological Survey, Denver, Colo.
For primary bibliographic entry see Field 7C.
W76-06446

THE EFFECT OF LAND USE ON THE CHEMICAL AND PHYSICAL QUALITY OF SURFACE AND GROUND WATERS IN SMALL WATER SHEDS, Massachusetts Univ., Amherst. Dept. of Plant and Soil Sciences.
For primary bibliographic entry see Field 5B.
W76-06552

EVALUATION OF POLLUTION ABATEMENT TECHNIQUES APPLICABLE TO LOST CREEK AND BROWN'S CREEK WATERSHED, WEST VIRGINIA, Ackenheil and Associates Geo Systems, Inc., Pittsburgh, Pa.
For primary bibliographic entry see Field 5G.
W76-06570

SOIL EROSION AND SEDIMENTATION IN TANZANIA AND LESOTHO, Secretariat for International Ecology, (Sweden). A. Rapp.
Ambio, Vol. 4, No. 4, p. 154-163, 1975. 9 fig, 1 tab, 17 ref.

Descriptors: *Soil erosion, *Sedimentation, *Africa, *Land management, *Land use, *Erosion control, Soil conservation, Surface runoff, Natural resources, Water resources development, Water utilization, Ecology, Environmental effects, Vegetation, Watershed management, Sedimentation rates.
Identifiers: Tanzania, Lesotho.

One of the necessary lines of action to change the negative trend of food and water shortages in many African countries is an improved and ecologically sound use of the natural resources of water, vegetation, and productive soil. In order to study types of soil erosion, monitor present rates of erosion and determine consequences of erosion, it is necessary to carry out continuous studies of water and sediment flow in natural watersheds under different environmental condi-

tions and different types of land use. These studies or 'catchment diagnoses' provide a sound basis for reclamation plans, which must be adapted to the local ecological and social conditions to be successful. Every land and water development scheme should be combined with critical evaluation of its impact on the environment and on man. In particular, the reactions of the environment to exploitation should be observed and conclusions drawn for better land use from these observations. In order to compare the situation before, during and after implementation of a plan, reliable reference data such as maps, photographs and descriptions must be obtained for land and water development projects. Initial mistakes can then be recognized and corrected by means of repeated comparisons or monitoring. (Robinett-Arizona)

W76-06593

INFLUENCE OF VESICULAR HORIZONS ON WATERSHED MANAGEMENT, Texas A and M Univ., College Station. Dept. of Range Science.
W. H. Blackburn, R. E. Eckert, Jr., M. K. Wood, and F. F. Peterson.
In: Watershed Management Proceedings Irrigation and Drainage Division American Society of Civil Engineers, August 11-13, 1975, Logan, Utah, p. 494-515. n.d. 11 fig, 7 tab, 6 ref.

Descriptors: *Soil horizons, *Soil surfaces, *Sediment yield, *Infiltration rates, *Plant growth, *Watershed management, Soil erosion, Arid lands, Organic matter, Topsoil, Ranges, Soil physical properties, Wettability, Soil structure, Soil strength.
Identifiers: *Seedling emergence, *Vesicular horizons.

Vesicular soil surface horizons are found extensively on arid and semiarid range lands in poorly aggregated dune interspace soils (dune interspace is the area between areas of accumulation of litter and soil under trees, shrubs and bunchgrasses). Vesicular horizons are the major factor contributing to low infiltration rates and sediment production from large areas of rangeland. The influence of vesicular horizons on infiltration rates, sediment production, and seedling emergence is discussed. Areas of litter and soil accumulation had infiltration rates near or exceeding the application rate of 3 inches per hour and sometimes 3 to 4 times greater than the dune interspace areas. Sediment is usually considerably higher from dune interspace areas than from areas of accumulation, and as dune interspace areas increase, sediment production increases. More sediment is produced from initially wet soils than those initially dry. This relationship is most marked for soils with a vesicular surface horizon. Seedling emergence was higher in areas of accumulation than in interspace soils. A decrease in organic matter content increased crust hardness, while an increase in the number of water applications decreased hardness. (Robinett-Arizona)

W76-06596

MANAGING CHAPARRAL FOR WATER AND OTHER RESOURCES IN ARIZONA, Forest Service (USDA), Tempe, Ariz. Rocky Mountain Forest and Range Experiment Station.
For primary bibliographic entry see Field 3B.
W76-06597

VEGETATION MANAGEMENT FOR WATER AND RANGE IMPROVEMENT, Arizona Univ., Tucson. School of Renewable Natural Resources.
For primary bibliographic entry see Field 3B.
W76-06598

BLACK RIVER BAROMETER WATERSHED IN RELATION TO THE RESOURCE MANAGER, Forest Service (USDA), Springerville, Ariz. Apache-Sitgreaves National Forest.

P. T. Stewart.

In: Watershed Management Proceedings Irrigation and Drainage Division American Society of Civil Engineers, August 11-13, 1975, Logan, Utah, p. 207-215. n.d. 2 tab.

Descriptors: *Watershed management, *Water yield, *Demonstration watersheds, *Regional analysis, *Natural resources, *Arizona, Land management, Surface runoff, Conservation, Climatic data, Hydrologic data, Planning, Management, Water resources, Land use, Training. Identifiers: *Black River Barometer Watershed(Ariz), Barometer watersheds.

The barometer watershed discussed is in Region 3 of the U.S. Forest Service on the Apache-Sitgreaves National Forests in east central Arizona. The primary thrust of the barometer watershed program is discussed. These watersheds are designed to be an index or a representative sample of each broad climatic-physiographic region and will be 30,000 to 150,000 acres in size so as to contain continuing programs of timber management, livestock grazing, recreation, wildlife and fishery habitat management, road and trail development, and other interrelated activities. The objectives of the Black River Barometer Operational Plan are: (1) management services, in which the ability to detect changes in water yield due to land use is evaluated; (2) improving methods and techniques used by soil scientists and hydrologists and adapting them to the requirements for use in the southwestern region; (3) to establish a hydrometeorological data bank; and (4) training evaluation and demonstration. (Robinet-Arizona) W76-06599

IDENTIFICATION AND TREATMENT OF DISPERSIVE CLAY SOILS,

Oklahoma State Univ., Stillwater. School of Civil Engineering. For primary bibliographic entry see Field 8D. W76-06611

SOIL STABILIZATION FOR EROSION CONTROL,

Purdue Univ., Lafayette, Ind. School of Civil Engineering. S. Diamond, and M. Kawamura. Available from the National Technical Information Service, Springfield, Va. 22161 as PB-242 842 \$5.50 in paper copy, \$2.25 in microfiche. Joint Highway Research Project 74-12, August 1974. 115 p, 46 fig, 6 tab, 17 ref.

Descriptors: *Erosion control, *Soil stabilization, Erosion, Erosion rates, Simulated rainfall, Portland cements, Lime, Construction. Identifiers: *Rainfall-erosion, Construction erosion control, Erosion tests, Aggregated size analysis, Crosby soil, Soil loss.

The potential utility of small percentages of hydrated lime or of Portland cement in stabilizing construction sites against rainfall erosion is under investigation. A laboratory rainfall simulator has been designed and constructed to provide a reproducible 'design storm' (3.25 in per hour intensity, applied for 1 h on each of two successive days). The design, development, and testing of the rainfall simulation equipment and of the associated sample preparation and test devices was described in Part I of this report; Part II described the experimental results as of November 1973. Under the test conditions unstabilized (but compacted) Crosby soil eroded to the equivalent of about 90 tons/acre. Treatment with 2.5% cement virtually eliminated soil loss; the same level of treatment with hydrated lime reduced it to the equivalent of about 3 tons/acre, but a curing time of several weeks was required. Even smaller percentages, down to 1%, resulted in significantly reduced erosion. A test stand of Alta fescue grass on the same soil was not as effective as the cement or lime treatments. (Lee - ISWS) W76-06639

STABILIZATION OF CLAY SOILS AGAINST EROSION LOSS,

Purdue Univ., Lafayette, Ind. School of Civil Engineering. M. Kawamura, and S. Diamond. Available from the National Technical Information Service, Springfield, Va. 22161 as PB-242 841 \$4.00 in paper copy, \$2.25 in microfiche. Joint Highway Research Project Report No. 75-4, March 1975. 31 p, 12 fig, 14 ref. FHA C-36-50H.

Descriptors: *Erosion control, *Clays, Erosion, Highways, Soil erosion, Porosity, Rainfall, Raindrops, Lime, Portland cements. Identifiers: *Hydrated lime stabilization, *Portland cement stabilization, Erosion resistance, Pore size distribution, Erosion soil loss, Soil loss, Water-stable aggregate distribution, Scanning electron microscope observations.

Accelerated soil erosion from construction sites and the resulting increase in downstream sediment load constitutes a significant environmental problem. Laboratory studies indicated that small percentages of hydrated lime or of Portland cement will stabilize clay soils against rainstorm erosion by preventing particle detachment. Coordinated measurements of the size distribution of water-stable aggregates, of pore size distribution by mercury porosimetry, and of microstructure by scanning electron microscopy and energy dispersive x-ray spectrometry were used to clarify aspects of the mechanisms responsible for the development of erosion resistance. Attainment of such resistance was marked by aggregation of a significant part of the clay into water stable aggregates of the order of several millimeters in size, and of minimal change in porosity and pore size distribution on exposure to the test rainstorms. At least some of the clay particles in the aggregations appeared to be partly converted to calcium-bearing reaction products, and formation of the 'reticulated network' variety of calcium silicate hydrate gel linking adjacent particles was demonstrated. (Lee-ISWS) W76-06640

5. WATER QUALITY MANAGEMENT AND PROTECTION

5A. Identification Of Pollutants

SALINITIES OF AMBIENT AND INTERSTITIAL WATERS OF SOME MASSACHUSETTS NORTH SHORE SALT-MARSHES, Massachusetts Univ., Amherst. For primary bibliographic entry see Field 5B. W76-06158

REGIONAL DISTRIBUTION OF THE MAJOR DISSOLVED SOLIDS IN THE STREAMS OF ILLINOIS, Northern Illinois Univ., De Kalb. Dept. of Geology. For primary bibliographic entry see Field 5B. W76-06163

ACETYLENE REDUCTION ASSAYS FOR NITROGEN FIXATION IN FRESHWATERS: A NOTE OF CAUTION, Manitoba Univ., Winnipeg. Dept. of Microbiology. R. J. Flett, J. W. M. Rudd, and R. D. Hamilton. Applied Microbiology, Vol. 29, No. 5, p. 580-583, 1975. 4 fig., 13 ref.

Descriptors: *Analytical techniques, *Nitrogen fixation, *Methane bacteria, On-site investigations, Metabolism, Oxidation, Assay, *Pollutant identification. Identifiers: *Acetylene reduction, Ethylene.

Since organisms fixing molecular nitrogen also reduce acetylene to ethylene, gas chromatographic determination of both gases are generally used to indirectly assess nitrogen fixation, but reproducible recovery of ethylene produced in acetylene reduction assays is essential. Microorganisms oxidizing methane in lakes were studied to determine if they could use ethylene. Lake samples transformed C14 ethylene into water soluble compounds undetectable by conventional acetylene reduction procedures; methane-oxidizing bacteria appeared responsible. About 28% of added ethylene was transformed and this figure is probably an underestimate. Depth distributions of methane-oxidizing and ethylene-transforming activities, temperature response curves, and substrate competition experiments indicated that the same organisms mediated methane oxidation and ethylene transformation. Whenever and wherever methane-oxidizing bacteria are active, acetylene reduction assays may be erroneous due to ethylene transformation. Metabolized ethylene was not incorporated into cellular material. Some metabolites were water-soluble, non-volatile compounds; carbon dioxide was not a major end-product. The assumption that ethylene produced during assay is not biologically or abiotically altered during incubation is sometimes invalid, causing errors in acetylene reduction assays used in environments containing methane-oxidizing bacteria. More confidence could be placed in acetylene reduction assays if ethylene stability were demonstrated by radiochemical techniques. If ethylene transformation occurred, only N15 techniques could be accurately used. (Buchanan-Davidson-Wisconsin) W76-06202

NATIONAL EUTROPHICATION SURVEY METHODS FOR LAKES SAMPLED IN 1972,

Pacific Northwest Environmental Research Lab., Corvallis, Oreg. For primary bibliographic entry see Field 5C. W76-06221

THE ECONOMIC VALUE OF REMOTE SENSING OF EARTH RESOURCES FROM SPACE: AN OVERVIEW AND THE VALUE OF CONTINUITY OF SERVICE. VOLUME IX. OCEANS.

Econ. Inc., Princeton, N. J. For primary bibliographic entry see Field 7B. W76-06222

A METHOD OF DETERMINING MORPHOPHYSIOLOGICAL INDICATORS IN THE ECOLOGY OF ROTIFERS (ROTATORIA), (IN RUSSIAN), Y. S. Chuikov. Ekologiya 5(5), p 95-97. 1974.

Descriptors: *Bioindicators, *Rotifers, Methodology, Ecology, Animal physiology, Microbiology, Eutrophication, Production. Identifiers: Keratella-Quadrata-Frenzelii, Keratella-Quadrata-Quadrata, Loricata, Rotatoria.

The isolation of some morphological indices, expressing the interaction of internal and external factors for rotifer populations as indicators of ecological conditions, is proposed. In addition to such external morphological indices as the shape and dimensions of the lorica and its formations, indices of the physiological state of internal organs are also valuable: form and size of the gonads, form of the ovarian nucleus and the gastric glands, number and dimensions of eggs or embryos, periods of latent egg production and, to a certain extent, the gnathic apparatus. The use of this method of morphophysiological indicators in studies associated with the anthropogenic eutrophication of waters is illustrated using Keratella-Quadrata-Quadrata and K. quadrata frenzelii. Copyright 1975, Biological Abstracts, Inc. W76-06231

Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

Group 5A—Identification Of Pollutants

PUBLIC GROUNDWATER SUPPLIES IN PUTNAM COUNTY,
Illinois State Water Survey, Urbana.
For primary bibliographic entry see Field 4B.
W76-06237

THE USE OF CHITOSAN COLUMNS FOR THE REMOVAL OF MERCURY FROM WATERS,
Ancona Univ. (Italy). Faculty of Medicines and Ancona Univ. (Italy). Chemistry Lab.
R. A. A. Muzzarelli, and R. Rocchetti.
J Chromatogr. 96(1): 115-121. Illus. 1974.

Descriptors: *Mercury, *Analytical techniques, *Radiochemical analysis, *Spectrometry, Absorption.
Identifiers: Chitosan columns, Eluting agents, Flameless atomic absorption.

The experimental conditions for the removal of ionic Hg from waters were studied. Columns containing 1-15 g of chitosan were used to lower the Hg concentration from 1-0.02 ppm, with volume reduction factors of 2000-10,000. Recycling of columns was carried out with 10 mM potassium iodide solution. Other inorganic and organic eluting agents were studied. The analytical instrumental techniques were flameless atomic-absorption spectrometry and radiochemistry. Copyright 1975, Biological Abstracts, Inc.
W76-06239

PUBLIC GROUNDWATER SUPPLIES IN MACOUPIN COUNTY,
Illinois State Water Survey, Urbana.
For primary bibliographic entry see Field 4B.
W76-06257

EVIDENCE FOR NEW ALUMINUM PHOSPHATE PHASE FROM REACTION RATE OF PHOSPHATE WITH ALUMINUM HYDROXIDE,
Agricultural Univ., Wageningen (Netherlands). Dept. of Soils and Fertilizers.
For primary bibliographic entry see Field 5E.
W76-06295

A TECHNIQUE FOR ESTIMATING ACTIVE NITRIFYING MASS AND ITS APPLICATION IN DESIGNING NITRIFYING SYSTEMS,
New York State Coll. of Agriculture and Life Sciences, Ithaca. Dept. of Agricultural Engineering.
E. G. Srinath, T. B. S. Prakasam, and R. C. Loehr. In: Proceedings of the 29th Industrial Waste Conference, Part Two, May 7-9, 1974, Lafayette, Indiana, Purdue University, p 1038-1048. 7 fig, 3 tab, 14 ref.

Descriptors: *Analytical techniques, *Nitrification, *Nitrogen, *Nitrites, Suspended solids, *Pollutant identification, Waste water treatment, Sludge, Aerobic treatment, Oxidation, Microorganisms.
Identifiers: Total Kjeldahl nitrogen, Mixed liquor volatile suspended solids, Nitrosomonas, Nitrobacter.

Various methods are available for estimating the active mass of the sludge in an aerobic treatment process, based on the biochemical characteristics of the aerobic organisms. In nitrifying systems, mixed liquor volatile suspended solids (MLVSS) is used as the parameter and is usually very crude. Results from research on the process of nitrification were used to develop a parameter for the active mass of nitrifying organisms. The oxidation rates of ammonium and nitrite of the mixed liquors (expressed as milligrams of substrate nitrogen oxidized per hour per milligram of cellular total Kjeldahl nitrogen (TKN) of the mixed liquor) were compared with the rates obtained with pure cultures of *Nitrosomonas europaea*, *Nitrobacter agilis*, and *N. winogradskyi* suspended at known

concentration (milligrams of cellular TKN/liter) in a mineral salt medium containing their respective substrates, ammonium and nitrite. The reference pH for determining the rates was in the range of 7.4 to 7.9 since the maximum rates were obtained in this range. The ratio between the specific rates of oxidation of the mixed liquor nitrifying population and the pure cultures under similar conditions of pH and temperature represents the fraction of the TKN of the mixed liquor as contributed by the cellular TKN of the autotrophic nitrifiers. This ratio when multiplied by the TKN concentration of the mixed liquor, gives the TKN concentration of the nitrifying organisms, which can be used as an estimate of their mass. (Pinto-FIRL)
W76-06296

NITROSOPHENOL AND NITROSONAPHTHOL DERIVATIVES AS REAGENTS FOR SPECTROPHOTOMETRIC DETERMINATION OF IRON AND DETERMINATION OF MICROAMOUNTS IN WATERS WITH 2-NITROSO-5-DIMETHYLAMINOPHENOL,
Okayama Univ. (Japan). Dept. of Chemistry.
K. Toei, S. Motomizu, and T. Korenaga.
The Analyst. Vol. 100, No. 1194, p 629-636, September, 1975. 5 tab, 38 ref.

Descriptors: *Spectrophotometry, *Analytical techniques, *Nitrogen compounds, Iron, *Pollutant identification, Rivers.
Identifiers: Nitroso compounds.

The iron(II) complexes of twenty-five nitroso compounds were examined spectrophotometrically in aqueous solution for suitability as analytical reagents for iron(II) ion. Although most of the complexes with nitroso compounds had a 1:3 composition in aqueous solution and chloroform, two complexes, nitroso-DMAP and nitroso-DEAP, had a 1:4 composition. Because of this, and because the ligands possess strong electron-donating groups, the molar absorptivities of the two complexes were very large. Although the molar absorptivity of the nitroso-DEAP complex was slightly larger than that of the nitroso-DMAP complex, the latter is more useful for the determination of micro-amounts of iron. Nitroso-DMAP is more stable, and the color of its complex with iron(II) in aqueous solution is stable for much longer than nitroso-DEAP. A spectrophotometric method using nitroso-DMAP was applied to the determination of iron in city and river waters. The method possessed several advantages. The complex formed had a molar absorptivity about four times as large as that formed with 1,10-phenanthroline. Diverse ions which are generally present in natural waters did not interfere in the determination. The nitroso-DMAP complex had a wide range of pH in which the full color developed, and the simplicity of the procedure allowed measurements to be carried out in aqueous solution. (Loustau-FIRL)
W76-06303

CADMIUM AND ZINC CONTENTS OF CORN LEAF AND GRAIN PRODUCED BY SLUDGE-AMENDED SOIL,
Illinois Univ. at Urbana-Champaign. Dept. of Agronomy.
R. L. Jones, T. D. Hinesly, E. L. Ziegler, and J. J. Tyler.
Journal of Environmental Quality, Vol. 4, No. 4, p 509-514, October/December, 1975. 5 fig, 3 tab, 10 ref.

Descriptors: *Cadmium, *Zinc, *Sludge treatment, *Soil analysis, Hydrogen ion concentrations, Sludge disposal, *Pollutant identification, Environmental effects, Anaerobic digestion.
Identifiers: Land application, Atomic absorption analysis.

Because the cadmium present in sludge-amended soil presents a hazard to plant and animal ecosystems, the patterns of concentrations of cad-

mium in plants have been related to soil pH. In animal and plant physiology, zinc is important to consideration of transport of cadmium across membranes, and levels of zinc in plant tissues were also reported. Sludge from high-rate anaerobic digesters was applied to three out of four plots of corn. Leaves and grains of the corn were sampled, and yield determinations were made. In addition, soil samples were taken. Cadmium and zinc were determined in the samples by atomic absorption analysis. The pH was determined from the soil samples in distilled water solutions. Decline in yield was the first apparent effect of some elemental excess. Increases in extractable cadmium and zinc from the sludge-amended soils was also a result. Uptake of cadmium was substantial in the case of leaves. Mechanisms appeared to operate in diminishing the concentration of cadmium in grains. Zinc contents resembled results for cadmium. Soil pH was found to interact significantly with cadmium levels in the soil to affect cadmium levels in the leaves. The interaction between pH and zinc has long been known. An important new observation was that above pH 7 when large amount of zinc were available, increases in cadmium levels in leaves were not observed. Substantial increases in zinc content could undoubtedly mediate any negative effects of sludge-enhanced cadmium levels. Furthermore, sludges that would be applied to plants for nutrients would be applied in considerably smaller amounts. (Loustau-FIRL)
W76-06304

CHEMICAL ANALYSIS AND ENVIRONMENTAL QUALITY,
H. Egan.
Chemistry and Industry, No. 19, p 814-820, October 4, 1975. 44 ref.

Descriptors: *Water analysis, *Analytical techniques, *Pollutant identification, Chemical analysis, Monitoring, Measurement, Water quality.

Chemical analysis can provide a measurement of the various factors which need to be taken into account in evaluating environmental quality. It can measure the level of substances, usually trace substances, which intrude in the atmospheric, aquatic or terrestrial environment, and can contribute to an understanding of the possible interaction between these factors. This article discusses various chemical monitoring methods: electro-optic devices based on ultraviolet absorption for measuring sulfur dioxide; a flame-photometric detector for sulfur compounds; infrared gas analysis and chemical reaction for measuring carbon monoxide; and, lasers for monitoring ozone, ethylene and other trace constituents in the atmosphere. Analytical methods for monitoring pollutants in aquatic environments include atomic absorption, atomic fluorescence, atomic emission and mass spectrometry, and neutron activation analysis. Study of the terrestrial environment has brought about the development of new multidetection or multiresidue methods such as gas-liquid chromatographic multidetection. There is even a growing interest in the monitoring of the total environment by remote sensing techniques. (Loustau-FIRL)
W76-06308

A FEW CONSIDERATIONS ON THE MEASUREMENT OF PORE SIZE DISTRIBUTION OF ACTIVATED CARBON (KASSEITAN NO SAIKOKU BUNPU SOLUTEI NI KANSURU 2,3 NO KOSATSU),
For primary bibliographic entry see Field 5D.
W76-06309

MEASUREMENT IN WATER RESEARCH: PART I.
Measurement and Control, Vol. 8, No. 11, p 440-441, November, 1975. 1 fig.

WATER QUALITY MANAGEMENT AND PROTECTION—Field 5

Identification Of Pollutants—Group 5A

Descriptors: *Water analysis, *Pollutant identification, *Analytical techniques, Heavy metals, Equipment, Instrumentation.

The Water Research Centre, Buckinghamshire, U. K., is responsible for all aspects of water supply and disposal including resources, potable water treatment, quality, and distribution, sewage treatment, industrial wastes treatment, water pollution, and sewerage. Some of the techniques used at the WRC to identify pollutants are described. A gas chromatography/mass spectrometer is used to measure organic compounds such as oils, plastics, and pesticides. Although glass capillary columns have many advantages over the stainless steel columns usually used in hydrocarbon analysis, the experimental difficulties associated with their preparation and their limited commercial availability have inhibited their use. The WRC is investigating the application of some newer types of glass columns for research and routine work in water analysis. High-pressure liquid chromatography permits materials at low concentrations to be determined relatively easily. The WRC is evaluating a flameless atomic absorption spectroscopy technique for the determination of trace metals. Anodic stripping voltammetry is an electroanalytical technique for the determination of trace metals; it has been used for the analysis of potable water, seawater, and sewage and sewage effluents. Emission spectrographic analyses were performed on water samples from rivers in England and Wales to determine the baseline concentrations of trace metals in these rivers. (Orr-FIRL) W76-06310

EARTHWATCH.

National Oceanic and Atmospheric Administration, Rockville, Md. Deep Water Ports Project Office.
C. E. Jensen, D. W. Brown, and J. A. Mirabito.
Science, Vol. 190, No. 4213, p 432-438, October 31, 1975. 6 figs, 1 tab, 22 ref.

Descriptors: *Monitoring, *Data collections, *Research and development, *Information exchange, Environmental effects, Water pollution, Air pollution, *Pollutant identification.
Identifiers: *Earthwatch.

Earthwatch, part of the United Nations Environment Program, is a four-part program involving monitoring, research, evaluation, and information exchange. The program, which was created in June, 1972, will provide the basis for global environmental management and supporting measures. The monitoring aspect of Earthwatch will be done at stations all over the world and in conjunction with organizations already established by the United Nations. Research activities include atmospheric research, and oceanic exploration. Information exchange will complement the activities and services already provided by the World Data Center. Eventually the framework for Earthwatch will be nongovernmental assessment centers around the world. (Loustau-FIRL) W76-06321

TRACE ELEMENT CONCENTRATIONS OF SEWAGE TREATMENT PLANT EFFLUENTS AND SLUDGES; THEIR INTERACTIONS WITH SOILS AND UPTAKE BY PLANTS.
California Univ., Riverside. Dept. of Soil Science and Agricultural Engineering.
For primary bibliographic entry see Field 5B. W76-06332

BEHAVIOUR OF OIL UNDER CANADIAN CLIMATIC CONDITIONS PART 1. OIL ON WATER UNDER ICE-FORMING CONDITIONS.
Department of the Environment, Ottawa (Ontario). Inland Waters Directorate; and Department of the Environment, Ottawa (Ontario). Water Quality Branch.
For primary bibliographic entry see Field 5G. W76-06366

EXAMINATION OF SEWAGE AND SEWAGE SLUDGE FOR ENTEROVIRUSES, VOLUME 1.
Ontario Ministry of Health, Toronto.
Canada-Ontario Agreement on the Great Lakes Water Quality, Research Report No. 27, Training and Technology Transfer Division (Water), Environmental Protection Service, Environment Canada, Ottawa, Canada, March 1975, 35 p, 11 tab, 47 ref. 72-5-1.

Descriptors: *Sewage sludge, Sewage, Pollutants, Environment, Microorganisms, Electron microscopy, Nutrients, Heavy metals, *Pollutant identification.
Identifiers: *Enteroviruses, *Agricultural land, Chloroform, Poliovirus, Vaccines, Urban sewage, Rural land.

A promising and practical method for taking advantage of the nutrient qualities of sewage sludge is to spread it on agricultural or grass land in rural areas. This method, however, carries an inherent risk that the environment may be polluted further with harmful agents such as viruses and heavy metals. This report deals with the first phase of a virus monitoring program being carried out in the Enterovirus Laboratory of the Ontario Ministry of Health, in connection with the plans to spread urban sewage sludge on rural land in Ontario. The results of this program include virus surveillance studies on five Ontario plants which employ different phosphate removal techniques, as well as related laboratory studies. (Environment Canada) W76-06371

WATER QUALITY DATA ALBERTA 1961 - 1973.

Department of the Environment, Ottawa (Ontario). Inland Waters Directorate; and Department of the Environment, Ottawa (Ontario). Water Quality Branch.
For primary bibliographic entry see Field 7C. W76-06374

SODIUM, POTASSIUM, CALCIUM AND MAGNESIUM CONTENT OF NORTHWEST ARKANSAS RAIN WATER IN 1973.
Arkansas Univ., Fayetteville. Dept. of Geology.
For primary bibliographic entry see Field 2B. W76-06379

CHROMATOGRAPHIC DETERMINATION OF DMA AND DMF IN AQUEOUS MEDIUM.
Vysoka Skola Chemicko-Technicka, Prague (Czechoslovakia). Dept. of Petroleum Technology and Petrochemistry.
V. Kubelka, J. Mitera, V. Rabl, and J. Mostecký.
Water Research, Vol. 10, No. 2, p 137-138, February 1976. 2 tab, 12 ref.

Descriptors: *Pollutant identification, *Gas chromatography, *Mass spectrometry, *Analytical techniques, *Instrumentation, *Organic compounds, Analysis, Chromatography, Chemistry, Evaluation, Water analysis, Water chemistry, Water quality, Estimating, Pollutants, Chemical analysis, Water pollution, Aqueous solutions.
Identifiers: *Dimethylamine(DMA), *Dimethylformamide(DMF), Flame-ionization detector, Total ionic current, Collector current, Organic sorbents.

The reliability of data on the contents of dimethylamine (DMA) and dimethylformamide (DMF) in water using gas chromatography and the gas chromatograph-mass spectrometer combination was assessed. Regarding the practical requirements of the industry, attention was concentrated on the concentration range of 0 to 500 mg/l. Using gas chromatograph with the flame-ionization detector, hundreds of ppb of DMA and the ppm level of DMF can be determined in aqueous solutions. With gas chromatography-mass spectrometer system, monitoring the total ionic current, similar concentrations are detectable as with the flame-

ionization detector, but the detection limit is substantially lowered to 10 ppb for both DMA and DMF, when the collector current is monitored. (Henley-ISWS) W76-06390

SEMI-AUTOMATED AMMONIA PROBE DETERMINATION OF KJELDAHL NITROGEN IN FRESHWATERS.
Ministry of Agriculture, Antrim (Northern Ireland). Freshwater Biological Investigation Unit.
R. J. Stevens.
Water Research, Vol. 10, No. 2, p 171-175, February 1976. 3 fig, 1 tab, 18 ref.

Descriptors: *Ammonia, *Analytical techniques, *Membranes, *Nitrogen compounds, *Water analysis, Ammonium compounds, Nitrogen, Inorganic compounds, Analysis, Membrane processes, Chemical analysis, Color reactions, Chemistry, Evaluation, Instrumentation, Testing procedures, Distillation, Freshwater, Spectrophotometry, Automation.
Identifiers: *Ammonia probe, *Specific ion electrode, *Kjeldahl nitrogen, Technicon autoanalyzer, Distillation-Nesslerisation, Polytetrafluoroethylene membrane, Kjeldahl method, Automated digestion, Flow-through system.

A commercially available ammonia probe was used in an automated continuous flow-through system to determine the ammonia-N concentration in Kjeldahl digests of fresh waters. The method is suitable for samples with Kjeldahl-N concentrations greater than 0.1 mg N/l. In the 0.1-1.0 mg N/l range 10 digests/h can be analyzed. Only micro-digestion equipment and sample volumes of 25 ml are required. The ammonia probe with modified filling solution and polytetrafluoroethylene membrane is sufficiently stable for continuous use throughout a working day. Analyses of Kjeldahl digests of freshwater samples by this method and the distillation-Nesslerisation procedure showed good agreement. More precise results were obtained by the ammonia probe method. The ammonia probe method obviates the steam-distillation operation which is time-consuming and during which errors can be easily introduced by loss or gain of ammonia. (Henley-ISWS) W76-06391

GROUND-WATER QUALITY IN SELECTED AREAS SERVICED BY SEPTIC TANKS, DADE COUNTY, FLORIDA.
Geological Survey, Tallahassee, Fla.
For primary bibliographic entry see Field 5B. W76-06442

THE LOWER WILCOX AQUIFER IN MISSISSIPPI.
Geological Survey, Jackson, Miss.
For primary bibliographic entry see Field 7C. W76-06444

THE MIOCENE AQUIFER SYSTEM IN MISSISSIPPI.
Geological Survey, Jackson, Miss.
For primary bibliographic entry see Field 7C. W76-06445

WATER RESOURCES OF THE THRUST BELT OF WESTERN WYOMING.
Geological Survey, Cheyenne, Wyo.
For primary bibliographic entry see Field 7C. W76-06448

WATER RESOURCES DATA FOR GEORGIA, WATER YEAR 1975.
Geological Survey, Doraville, Ga.
For primary bibliographic entry see Field 7C. W76-06451

Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

Group 5A—Identification Of Pollutants

SOUTHEASTERN MICHIGAN WATER-RESOURCES STUDY: GROUND WATER AND GEOLOGY, Geological Survey, Lansing, Mich.
For primary bibliographic entry see Field 4B.
W76-06457

PROGRESS REPORT ON THE WATER RESOURCES INVESTIGATION OF MARTIN COUNTY, FLORIDA, Geological Survey, Tallahassee, Fla.
For primary bibliographic entry see Field 4B.
W76-06459

MULTIVARIATE AND SEQUENTIAL STATISTICAL PROCEDURES IN THE BIOLOGICAL ASSESSMENT OF WATER QUALITY, Colorado State Univ., Fort Collins. Dept. of Statistics.
T. T. Keefe, and E. P. Bergersen.
August 1975. 82 p, 20 fig, 13 tab, 57 ref, append.
14-06-D-7550.

Descriptors: *Water quality, *Statistical methods, *Graphical analysis, Fish behavior, *Biological communities, Aquatic communities, *Bioindicators.
Identifiers: *Species diversity.

Research on the application of multivariate and sequential statistical procedures in the biological assessment of water quality is described. Graphical presentation of bivariate statistical analysis was developed and found to be ideal for the interpretation of biologically based water quality data where two responses can be measured on the same experimental unit. A progress statement on the suitability of a graphical trivariate approach to assessing water quality is also presented. A technique for graphical display of $R \times 3$ contingency tables was applied to the problem of detecting differences among aquatic communities with respect to functional biological groups and was found to be well-suited for visually inspecting such differences. Confidence interval estimation of White's measure of association between two categorical variables was developed and applied to an evaluation of fish movements in response to changing water quality. To facilitate the application of the Sequential Comparison Index (SCI), several procedures, based on statistical designs, are presented for sample selection and processing. Sequential statistical procedures were found to be a potentially time-and-cost saving technique for biologically assessing water quality; application of this technique with SCI data was shown to provide a rapid first approach to identifying station differences in species diversity. (Bureau of Reclamation)
W76-06561

ACROLEIN RESIDUES IN IRRIGATION WATER AND EFFECTS ON RAINBOW TROUT, Bureau of Reclamation, Denver, Colo. Engineering and Research Center.
For primary bibliographic entry see Field 5C.
W76-06563

IN REGARD TO THE QUESTION OF THE DETERMINATION OF HEAVY METALS IN RIVER WATERS WITH THE AID OF RADIONUCLIDE X-RAY FLUORESCENCE ANALYSIS, (IN GERMAN), Staatliches Forschungsinstitut Geochemisches, Bamberg (West Germany).
H. Meier, E. Unger, W. Albrecht, D. Boesche, and W. Hecker.
Mikrochim Acta 5/6, p 505-518, 1975.

Descriptors: *Pollutant identification, *Heavy metals, Rivers, *X-ray fluorescence, Radioisotopes, Sediments, Suspended solids.

The fundamentals of energy-dispersive X-ray fluorescence analysis involving radioactive nuclide sources in combination with Si(Li) semiconductor detectors or proportional counter tubes are discussed. Examples are given to show that the procedure is suitable for the rapid determination of dissolved or suspended pollutants of river waters and sediments. Direct analysis of water samples and analysis of specimens without preliminary chemical treatment by evaporation or centrifugation are possible. Concentrations of 0.1 ppm are the detection limits.—Copyright 1975, Biological Abstracts, Inc.
W76-06619

TAXONOMY OF KLEBSIELLA PNEUMONIAE ISOLATED FROM PULP/PAPER MILL WASTE-WATER, Pacific Northwest Environmental Research Lab., Corvallis, Ore.
For primary bibliographic entry see Field 5C.
W76-06645

ENVIRONMENTAL APPLICATIONS OF ADVANCED INSTRUMENTAL ANALYSIS: ASSISTANCE PROJECTS, FY 74, Southeast Environmental Research Lab., Athens, Ga.
A. L. Alford.
Available from the National Technical Information Service, Springfield, Va. 22161, as PB-247 056, \$4.00 in paper copy, \$2.25 in microfiche. Report EPA-660/4-75-004, June 1975. 30 p, 10 tab, 10 ref. EPA 1BA027; 16020 GHZ.

Descriptors: Water pollution sources, *Pollutant identification, *Analytical techniques, Industrial wastes, Gas chromatography, Mass spectrometry, Neutron activation analysis, *Instrumentation, Measurement.
Identifiers: Spark source mass spectrometry, Multi-element analysis.

The Analytical Chemistry Branch of the Southeast Environmental Research Laboratory identified and measured aquatic pollutants under seven projects in answer to requests for assistance from other EPA organizations and other government agencies. In most cases these analyses helped to solve, or at least to understand more clearly, the related pollution incident and in some cases provided evidence for enforcement of regulatory legislation. Under an additional project, analytical consultations were held as requested by various organizations concerned with pollution incidents. (EPA)
W76-06647

ANALYTICAL QUALITY ASSURANCE FOR TRACE ORGANICS ANALYSIS BY GAS CHROMATOGRAPHY/MASS SPECTROMETRY, Environmental Monitoring and Support Lab., Cincinnati, Ohio.
J. W. Eichelberger, W. M. Middleton, and W. L. Budde.
Available from the National Technical Information Service, Springfield, Va. 22161, as PB-245 823, \$3.50 in paper copy, \$2.25 in microfiche. Report EPA-600/2-75-007, September 1975. 12 p, 4 fig, 2 tab, 7 ref. 1BA027; ROAP 09ABZ; Task 001.

Descriptors: Potable water, *Pollutant identification, *Analytical techniques, Solvent extraction, *Gas chromatography, Trace elements, Water analysis, *Mass spectroscopy, Organic wastes.
Identifiers: Reagent blank interpretation, Trace organics.

Analytical quality assurance concepts are applied to the qualitative analysis of drinking water supplies for trace organics by liquid-liquid extraction and gas chromatography - mass spectrometry. Some of these concepts are also applicable to other methods of analysis. (EPA)
W76-06648

CHEMICAL/BIOLOGICAL RELATIONSHIPS RELEVANT TO ECOLOGICAL EFFECTS OF ACID RAINFALL, National Ecological Research Lab., Corvallis, Ore.
J. O. Reuss.
Available from the National Technical Information Service, Springfield, Va. 22161, as PB-244 409, \$4.50 in paper copy, \$2.25 in microfiche. Report EPA-660/2-75-032, June 1975. 46 p, 7 fig, 20 ref. EPA 1AAA006

Descriptors: Rainfall, Model studies, Ions, Water analysis, *Pollutant identification, Water chemistry, Soil chemistry, *Absorption, Ecology, Precipitation (Atmospheric).
Identifiers: Rainfall chemistry, *Acid rainfall, Soil acidification.

Problems of measurement and interpretation of rainfall acidity in terms of effects on the soil-plant system are discussed. The theory of the carbon dioxide-bicarbonate equilibria and its effect on rainfall acidity is given. The relationship of a cation-anion balance model of acidity in rainfall to plant nutrient uptake processes is discussed, along with its relationship to a model previously proposed in the literature. Average H^+ concentration calculated from pH measurements does not appear to be a satisfactory method of determining H^+ loading from rainfall if the rain is not consistently acid. Calculating loading from H^+ minus HCO_3^- , strong acid anions minus basic anions, or net titratable acidity is suggested. The flux of H^+ ions due to plant uptake processes and sulfur and nitrogen cycling is considered. H^+ is produced by oxidation of reduced sulfur and nitrogen compounds mineralized during decomposition of organic matter. Plant uptake processes may result in production of either H^+ or OH^- ions. Fluxes of H^+ from these processes are much greater than rainfall H^+ inputs, complicating measurement and interpretation of rainfall effects. The soil acidifying potential due to the oxidation of the NH_4^+ in rainfall is apparently of a similar magnitude to the direct acidity inputs. (EPA)
W76-06650

AUTOMATIC ORGANIC MONITORING SYSTEM FOR STORM AND COMBINED SEWERS, Raytheon Co., Portsmouth, R.I.
A. Tulumello.
Available from the National Technical Information Service, Springfield, Va. 22161, as PB-244 142, \$5.00 in paper copy, \$2.25 in microfiche. Report EPA-670/2-75-067, June 1975. 69 p, 30 fig, 9 tab, 3 append. 68-03-0262. 1BB034ROAP 21-ASY; Task 038.

Descriptors: Combustion, *Instruments, Recording instruments, Carbon dioxide, *Monitoring, Sampling, *Storm water, Organic wastes, Sewage, *Pollutant identification, Combined sewers.
Identifiers: Infrared, *Total organic carbon, Organic pollution, Combined sewage, Storm-related wastewaters, *Automatic monitoring.

Early in the program to develop a stormwater TOC (total organic carbon) system, it was established that continuous on-line TOC was the best method for the measurement of stormwater pollution loading. (See W76-00507). Hardware was assembled that would process stormwater samples containing high suspended solids and that would obtain a continuous signal proportional to the concentration of TOC in the sample. Synthetic samples of municipal raw influent charged with primary sludge were analyzed using the TOC analyzer. Data were also obtained on actual stormwater samples collected during storm events at Boston. Further modifications were made after these observations. Automatic circuitry designed to provide turn on, auto-zero, auto-span and sample line flushing was added to the hardware, and the system was installed at Boston Cottage Farm Storage Facility. Automatic continuous analyses were obtained dur-

ing storms on site at the Cottage Farm Storage Facility. (EPA)
W76-06651

THE RATE OF SPREAD OF FUEL OIL NO. 1,
Geological Survey of Sweden, Stockholm.
For primary bibliographic entry see Field 5B.
W76-06677

**MONITORING GROUND-WATER QUALITY
NEAR A SANITARY LANDFILL,**
Earthview, Incorporated, Toledo, Ohio.
G. R. Kunkle, and J. W. Shade.
Ground Water, Vol. 14, No. 1, p 11-20, January-
February 1976. 8 fig, 2 tab, 18 ref.

Descriptors: *Water quality, *Groundwater,
*Landfills, *Leachate, *Monitoring, *Michigan,
Groundwater movement, Water pollution, Sulfur
bacteria, Carbonates, Chemical degradation,
Reduction(chemical), Oxidation-reduction poten-
tial, Path of pollutants, Pollutants.
Identifiers: *Monroe County(Mich), *Hagman
Road Sanitary Landfill(Mich).

At the Hagman Road Landfill refuse is buried in
lacustrine and glacial till deposits consisting
mainly of silty clays. These clays overlie a thick
carbonate aquifer used locally for water supply.
The dominant direction of groundwater flow is
vertically down. Time of groundwater travel from
the refuse to the aquifer was estimated at 12 years,
putting first arrivals in 1978. Water quality moni-
toring of bedrock waters showed decreases in total
dissolved solids, sulfates, calcium, magnesium,
chlorides, and total hardness with increases in al-
kalinity to exist locally beneath the landfill. The
principal chemical reaction felt to explain some,
but not all, of the water quality changes is sulfate
reduction. Theoretical geochemical modellings
helped to support this interpretation. The landfill
was hypothesized to have either triggered or ac-
celerated sulfate reduction by creating the reduc-
ing environment. (Gibb-ISWS)
W76-06684

**APPLICATIONS OF AEROSPACE TECHNOLOGY
IN THE PUBLIC INTEREST: POLLUTION
MEASUREMENT,**
Denver Research Inst., Colo.
For primary bibliographic entry see Field 5C.
W76-06710

**A PHOTOCHEMICAL SIDE REACTION THAT
INTERFERES WITH THE PHENOL-
HYPOCHLORITE ASSAY FOR AMMONIA,**
California Univ., Davis. Dept. of Food Science
and Technology.
N. Gravits, and L. Gleye.
Limnology and Oceanography, Vol. 20, No. 6, p.
1015-1017, 1975. 3 fig., 5 ref.

Descriptors: *Analytical techniques, *Ammonia,
*Sea water, *Light, *Chemical reactions, Spec-
trophotometry, Assay.
Identifiers: Phenolphthalein assay.

Exposure to sunlight of the reaction mixture for
the phenolphthalein assay for ammonia in sea-
water results in the formation of a compound ten-
tatively identified as indophenol, the same com-
pound that is formed in the presence of ammonia.
The photochemical side reaction of reagent blanks
made with distilled water results in a yellow
coloration within minutes. The solution then
slowly turns green with continued exposure to
sunlight. After an hour of exposure the absorbance
of these solutions at 640 nm is typically between
0.2 and 0.3 absorbance units. Similar color changes
are observed when assay mixtures containing am-
monia standards in either distilled water or sea-
water are exposed to sunlight. The concentration
of the interfering compound increases with ex-
tended exposure and its formation ceases with the

solution is removed from light. The interference
reaction can be prevented by wrapping the sample
containers with aluminum foil before adding re-
agents and by assuring that the sample is not ex-
posed to sunlight while it is being transferred to
the cuvette and placed in the spectrophotometer.
It is also suggested that the nitroprusside reagent
and phenol solution be protected against light ex-
posure. It is possible, too, that artificial laboratory
lighting may interfere with the assay. (Auen-
Wisconsin).
W76-06712

**THE ACID-BUBBLING METHOD FOR PRIMA-
RY PRODUCTIVITY MEASUREMENTS
MODIFIED AND TESTED,**
Iceland Univ., Reykjavik. Science Inst.
P. Theodorsson, and J. O. Bjarnason.
Limnology and Oceanography, Vol. 20, No. 6, p.
1018-1019, 1975. 5 ref.

Descriptors: *Primary productivity, *Analytical
techniques, *Laboratory tests, Carbon, Car-
bonates, Organic matter.
Identifiers: Acid-bubbling method.

When estimating the primary productivity by
separating the C14-carbonate from newly assim-
ilated C14-labeled organic matter by acidifying the
sample and driving the carbon dioxide out with a
stream of air, it was found that the C14 activity of
the sample containing the labeled algae seemed to
decrease even after all the C14-carbonate had sup-
posedly been driven off. A study indicated that no
activity was actually being lost from the bubbling
vessel, but some of the algae were sticking to the
wall of the Allihn tube, which would normally lead
to an underestimation of primary productivity but
could, in some cases, lead to a serious overestima-
tion. By shaking glass vials, adding 5 ml of Insta-
Gel to 5 ml of seawater, and bubbling the air
through a hypodermic needle, the adhesion of the
C14-labeled organic matter to the walls of the ves-
sel was eliminated. The acid-bubbling method
measures not only the C14 activity of labeled or-
ganic matter inside the algae but also organic
matter excreted during normal metabolism of the
cells. The 5-15% of the total C14 activity in the fil-
trate was measured and added to the activity of the
filter. (Auen-Wisconsin).
W76-06716

**TELEDETECTION BY AIRPLANE AND SATEL-
LITE IN THE STUDY OF MARINE POLLU-
TION, (IN FRENCH),**
Centre d'Etudes et de Recherches de Biologie et
d'Océanographie Médicale, Nice (France).
M. Aubert, J. P. Breittmayer, and Tan N'Guyen.
Rev Int Océanogr Med 39/40, p 33-52, 1975.

Descriptors: *Remote sensing, *Aerial photog-
raphy, Water pollution, *Pollutant identification,
Satellites(Artificial).
Identifiers: *Teledetection, Marine pollution.

The use of aircraft and satellites gives new possi-
bilities in the studies of marine pollutions. Aerial
photography facilitates exploration of restricted
areas with good precision, allowing direct compu-
tation of pollutant concentration. Documents
transmitted by satellites in the 500-600 and 600-700
nm wavelength show sources and extent of pollu-
tion; diffusion of the most important pollutants
can be analyzed on the photos. Combined use of
these 2 methods of analysis of marine water bodies
allows study of peculiar local situations and their
consideration in a general hydrological context.
Copyright 1975, Biological Abstracts, Inc.
W76-06717

**APPARATUS FOR THE IN SITU CONCENTRA-
TION OF TRACE METALS FROM SEAWATER,**
Environmental Research Lab., Narragansett, R.I.
E. W. Davey, and A. E. Soper.
Limnology and Oceanography, Vol. 20, No. 6, p.
1019-1023, 1975. 2 fig., 6 ref.

Descriptors: *On-site tests, *Sea water, *Trace
elements, *Analytical techniques, Cadmium,
Chromium, Copper, Iron, Manganese, Nickel,
Lead, Zinc, Heavy metals.

An instrument designed to concentrate trace
metals from seawater in situ and thereby reduce
some potential sources of sample contamination is
described and illustrated. It is arranged to sample
at 10 cm from the sediment-water interface by at-
taching the filter and column directly to an anchor-
ing cement block and at 0.5 m below the air-water
interface by attaching filter and column directly to
a water collection bottle. Intermediate depths
could also be sampled by the addition of filter,
column, tubing, and bottle assemblies. The bottles
are suspended from a surface float so that they
remain at the same immersion depth regardless of
tidal cycles. This apparatus and grab sampling give
comparable trace metal results with seawater sam-
ples in the laboratory; however field measure-
ments vary especially in embayments, which are
due to metal flux changes imposed by tidal cycles,
intermittent anthropogenic metal inputs, or both.
This apparatus could be applied to monitoring
baseline trace metal levels, sewage and industrial
metal outfalls, offshore dumping sites, and diffu-
sion of heavy metals from polluted sediments. It
could be adapted for monitoring other compounds,
such as methylated mercury, chlorinated
hydrocarbons, amino acids, etc., by replacing the
Chelex-100 in the columns with resins specific for
the compound of interest. (Auen-Wisconsin)
W76-06721

A PISTON CORER FOR PEAT,
Woods Hole Oceanographic Institution, Mass.
A. C. Redfield.
Limnology and Oceanography, Vol. 20, No. 6, p.
1042-1045, 1975. 3 fig., 4 ref.

Descriptors: *Sampling, *Muck soils, Peat, Cores,
Lake sediments, Muds.
Identifiers: Piston corer.

An instrument is described which secures samples
of peat or other soft sediments with minimal
disturbance of structure, compression, or con-
tamination by material from other depths. Its spe-
cial virtue is the automatic control of the depth of
sampling. It has been used to sample salt marsh
peat from depths up to 25 ft, and by working
through a hole in ice cover, 19 ft of soft lake sedi-
ments have been secured from under 27 ft of
water. The construction and operation of the corer
is diagrammed. The first core, extending from the
surface to a 1 ft depth is cut by inserting the handle
in the upper hole of the template to ensure that the
piston remains immovable and forcing the core
barrel downward to the limit of its excursion,
when the upper end of the extension tube will cor-
respond in position to the second hole of the tem-
plate. The instrument is then withdrawn after
tightening a setscrew. A second core, from 1 to 2 ft
below the surface, is obtained after reinserting the
corer into the hole; the process is repeated until
five cores are obtained and may be continued to
greater depths by the attachment of extension rods
and tubes. Cores can be secured from any
predetermined depth. Two instruments have been
made to obtain cores of different diameter. Their
construction and dimensions are shown. (Auen-
Wisconsin)
W76-06724

**STUDY OF THE GENUS VIBRIO IN DRINKING
WATER, (IN SPANISH),**
Instituto Bacteriologico de Chile, Santiago.
For primary bibliographic entry see Field 5C.
W76-06731

**STUDY OF THE STRONTIUM 90/STRONTIUM
ISOTOPE BALANCE IN A LATVIAN LAKE, (IN
RUSSIAN),**
Akademija Nauk Latvviiskoi SSR, Riga. Inst. of
Biology.

Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

Group 5A—Identification Of Pollutants

M. P. Leinerte, D. R. Vadzis, Z. K. Kalnina, and Y. Y. Sloka.
Ekologiya 5(5), p 77-79, 1974.

Descriptors: Lake, Strontium radioisotopes, Mud, Radioisotopes, Plankton, Seasonal, Spectrophotometry, Radioactivity, Pollutant identification, Aquatic plants.
Identifiers: *Alburnus-Alburnus*, *Elodea-Canadensis*, *Equisetum-Limosum*, *Esox-Lucius*, *Nuphar-Luteum*, *Perca-Fluviatilis*, *Phragmites-Communis*, *Strontium-90*, *Typha-Latifolia*, *USSR (Latvia), *Isotope balance (Lakes).

To study the isotope balance of the lake, the stable Sr level was determined by atomic absorption spectrophotometry and the Sr90 level was determined the oxalate Y90 separation techniques in Lake Engures of the Latvian SSR (USSR). Seasonal variations in these levels are observed. The higher the stable Sr level, the higher was the radioactive Sr in the water, plants and fish. Toward the end of the vegetation period, the levels of both isotopes increased in the lake water and plants, decreased in plankton, mud, and ichthyophagous fish and did not change in the sand or planktonophagous fish. The plants studies included *Equisetum limosum*, *Phragmites communis*, *Typha latifolia*, *Nuphar luteum* and *Elodea canadensis*. The fish studies were *Alburnus alburnus*, *Perca fluviatilis* and *Esox lucius*. The complete mixture of Sr and Sr90 had not yet occurred in this lake. --Copyright 1975, Biological Abstracts, Inc.
W76-06733

ON THE UNIVERSALITY OF THE POOLE AND ATKINS SECCHI DISK-LIGHT EXTINCTION EQUATION,
Agricultural Research Service, Phoenix, Ariz. Water Conservation Lab.
S. B. Gilbert, and R. Gene.
J Appl Ecol 11(1), p 399-401, 1974.

Descriptors: Ponds, Sewage, *Arizona, *Secchi disks, Equations, *Light penetration, Measurement.
Identifiers: *Light extinction equation, *Poole and Atkins equation.

On 26 clear days during the year April 1971-March 1972, K(extinction coefficient) and ZSD (Secchi disk depth) measurements were made in a small manmade pond filled with renovated sewage water of the Flushing Meadows reclamation project at Phoenix, Arizona. The results of the determinations of K, and ZSD at Flushing Meadows are plotted on a log-log scale, along with additional data. The Poole and Atkins equation possesses a universality that should provide a sufficiently accurate estimate of light extinction in all types of water for many biological studies lacking detailed light profile measurements. --Copyright 1975, Biological Abstracts, Inc.
W76-06737

THERMODYNAMIC LIMITATIONS ON THE USE OF THE PLATINUM ELECTRODE IN EH MEASUREMENTS,
M. Whitfield.
Limnol Oceanogr 19(5), p 857-865, 1974.

Descriptors: *Thermodynamics, Estuaries, Electrodes, Hydrogen ion concentration, Oxygen, Measurement, *Estuarine environment, Oceans, *Oxidation - reduction potential, *Pollutant identification.
Identifiers: Platinum electrodes.

The thermodynamic stability of surface oxide and sulfide coatings on the Pt electrode is considered. In well mixed environments thermodynamic considerations and experimental evidence suggest that the platinum surface acts as an oxide electrode that responds to pH rather than to O₂ partial pressure. In stagnant conditions in the marine or

estuarine environment the slow formation of Pt sulfide may push the measured Eh values to more negative potentials if permanently emplaced electrodes are used. These reactions may restrict the operational use of Eh measurements. --Copyright 1975, Biological Abstracts, Inc.
W76-06738

DETERMINATION OF PARTS PER BILLION SULFIDE IN WATER WITH THE SULFIDE-SELECTIVE ELECTRODE,
Du Pont de Nemours (E. I.) and Co., Aiken, S. C. Savannah River Lab.
E. W. Baumann.
Anal Chem 46(9), p 1345-1347, Illus. 1974.

Descriptors: *Pollutant identification, *Electrodes, *Sulfides, Water analysis, Analytical techniques, Methodology.

The sulfide-selective electrode is well suited for the routine determination of total sulfide in water because of simplicity of measurement and absence of interferences. A procedure issued by Orion, with a sulfide antioxidant buffer of sodium salicylate ascorbic acid and sodium hydroxide, will determine sulfide contents as low as 0.1 ppm. This sensitivity was extended to 30 ppb by removal of heavy metals (identified as Cu and Cr) from the sodium salicylate by dithione extraction. Because this sensitivity was still inadequate to determine sulfide concentrations in natural waters, a preconcentration step was incorporated to extend the determination to a lower ppb range. The sulfide was separated as ZnS, coprecipitated with Zn(OH)₂, and subsequently dissolved in alkaline EDTA-ascorbic acid solution for potentiometric measurement with the sulfide-selective electrode. The procedure without the preconcentration step was used to determine higher concentrations of sulfide. --Copyright 1975, Biological Abstracts, Inc.
W76-06744

NEUTRON ACTIVATION ANALYSIS OF SOME OF THE BIOLOGICALLY ACTIVE TRACE ELEMENTS IN FISH,
Pennsylvania State Univ., University Park, Dept. of Nuclear Engineering.
K. K. S. Pillay, C. C. Thomas, Jr., and C. M. Hyche.
J Radioanal Chem 20(2), p 597-606, 1974.

Descriptors: *Pollutant identification, *Trace elements, *Neutron activation analysis, *Lake Erie, Analytical techniques, Fish, Copper, Mercury, Cadmium, Zinc, Chromium, Spectrometry.
Identifiers: Arsenic, Selenium.

Highly specific neutron activation analysis procedures involving post irradiation chemical separations were developed for the determination of (environmental pollutants) Cu, Hg, Zn, Cd, As, Se and Cr in fish tissues. The procedures developed were used to determine the levels of these biologically active elements in some of the commercially important fish species of Lake Erie. The nuclear analytical procedures developed generally involved the irradiation of fish tissues followed by wet-ashing in the presence of non-radioactive carriers. From the homogeneous solution of the tissue digest, the elements of interest were chemically isolated and the radioactivities were measured by scintillation gamma ray spectrometry. The results include both the determination of the precision and accuracies of each of these elemental analyses and a survey of these 7 elements in 9 major fish species of Lake Erie. --Copyright 1975, Biological Abstracts, Inc.
W76-06753

CHLOROPHYLL A CONTENT AS AN INDEX OF PERIPHYTON PRODUCTIVITY, EXEMPLIFIED BY LAKE KRASNOE, (IN RUSSIAN),
S. L. Basova.
Ekologiya 5(2), p 73-74, 1974.

Descriptors: *Chlorophyll, *Periphyton, Lakes, *Productivity, Biomass, Bioindicators, Ponds, Pollutant identification, Reeds, Seasonal.
Identifiers: Bulrush, Grass, *USSR (Lake Krasnoe).

Samples of periphyton were collected in the summer and fall of 1971 in Lake Krasnoe (Karelian isthmus (Russian SFSR, USSR). The periphyton biomass on different substrates was established and the content of chlorophyll a was determined spectrophotometrically. When considering chlorophyll a as an index of biomass it is important to know its relative content in Periphyton. It varied from 0.02-0.24% of fresh weight for periphyton of reedgrass, 0.10-0.33% for pondweed, 0.09-0.18% for bulrush and 0.02-0.56% for stones. On the assumption that the biomass expressed on a fresh weight basis is 10 times greater than the dry weight, the average relative content of chlorophyll in the periphyton of Lake Krasnoe is 1.2-1.7% of the dry weight of the periphyton. --Copyright 1975, Biological Abstracts, Inc.
W76-06772

THE DETERMINATION OF CARBOHYDRATES IN NATURAL WATERS: A COMPARISON OF PAPER CHROMATOGRAPHIC, COLORIMETRIC AND ENZYMATIC METHODS, (IN GERMAN),
Freiburg Univ. (West Germany). Limnologisches Institut.
A. Geller.
Arch Hydrobiol Supplement 47(3), p 295-324, 1975.

Descriptors: *Carbohydrates, *Chromatography, *Colorimetry, Enzymes, Analytical techniques, Assay, Pollutant identification.
Identifiers: Aphanizomenon, *Enzymatic method, Paper chromatography, Saccharide, Sphaerotilus.

In limnology and oceanography estimation of carbohydrates is mainly done by paper chromatography and colorimetric tests, e.g., the anthrone method for determination of total hexoses. Paper chromatographic and colorimetric methods usually employed in limnology and other paper chromatographic, colorimetric and enzymatic assays were investigated and compared for sensitivity, specificity and applicability to carbohydrate analysis of natural waters. The carbohydrate contents of Aphanizomenon and Sphaerotilus were determined after acid hydrolysis as monosaccharides by these methods. --Copyright 1975, Biological Abstracts, Inc.
W76-06773

THE HEAVY METAL CONCENTRATIONS IN THE MARINE SEDIMENTS ALONG THE COAST OF FUKUYAMA, (IN JAPANESE),
Kagoshima Univ. (Japan). Marine Biology Lab. and Kagoshima Univ. (Japan). Environmental Sciences.
A. Inoue, and S. Asakawa.
Mem Fac Fish Kagoshima Univ 23, p 209-216, 1974.

Descriptors: *Heavy metals, Coasts, *Sediments, Spectrophotometry, Pollutant identification.
Identifiers: Eutrepia-sp, Exuviaella-sp, Heavy, *Japan (Fukuyama).

The heavy metal contents in the marine sediments (Japan) were evaluated by atomic absorption spectrophotometry. The heavy metals ordinarily included 2400-3100 microgram/g of dried matter for Fe, 280-790 for Mn, 8-21 for Co, 13-100 for Cu, 70-700 for Zn, 16-95 for Ni and 1.0-3.9 for Cd. No definite difference was recognized for any metals between the contents of the upper layer (0-5 cm from the surface) and those of lower layer (10-15 cm). The mean quantities of extractable heavy metals in the marine sediments of this district were: 2000 microgram/g of Fe/g of dried matter, 280 of Mn, 6 of Co, 20 of Cu, 90 of Zn, 6 of Ni and

1 of Cd. High concentration of extractable Fe and Mn suggested that the elution of those metals from marine sediments would constantly occur and maintain the long lasting blooms of dinoflagellates, such as *Euxyiaella* sp. and *Eutryptella* sp.—Copyright 1975, Biological Abstracts, Inc. W76-06774

5B. Sources Of Pollution

APPLICATIONS OF LINEAR TIME SERIES MODELS AND STEPWISE REGRESSION MODELS TO SELECTED WATER QUALITY DATA ON THE CONNECTICUT RIVER. Massachusetts Univ., Amherst. School of Health Sciences.

A. J. Gross, and R. C. Galkiewicz. Available from the National Technical Information Service, Springfield, Va. 22161 as PB-251 557 \$3.00 in paper copy, \$2.25 in microfiche. Massachusetts Water Resources Research Center, Publication No. 37, November, 1973. Completion Report FY 74-4, 36 p, 2 fig, 15 tab, 6 ref, append. OWRT A-062-MASS(1).

Descriptors: *Time series analysis, *Regression analysis, *Model studies, *Connecticut River, Data collections, *Dissolved oxygen, *Coliforms, Forecasting, Estimating, Water pollution sources, Computer programs.

Identifiers: Autoregressive models, ARMA models, White noise models.

Each water quality data set for the Connecticut River is fitted by a linear time series model, undergoes a stepwise multiple regression, and has its residuals fitted by a linear time series model. All data sets including both original and residual data sets are fitted adequately by either an autoregressive model, an ARMA model, or a white noise model. Using these data sets it was possible to forecast future dissolved oxygen readings (assuming conditions of continuity in the basin) at three sampling stations, as well as forecasting future coliform counts at two of these stations. The analyses show that all original data sets for which the white noise model is inappropriate are proportion saturated dissolved oxygen data sets. Furthermore, the tendency of proportion saturated dissolved oxygen appears downward in some years, e.g. 1962, but not always, e.g. 1963. An analysis of coliform counts could not be made because both original coliform data sets were fitted adequately by the white noise model. The pollution related independent variables which are most highly related to dissolved oxygen levels are pH and turbidity, although no strong relationship can be demonstrated. W76-06157

SALINITIES OF AMBIENT AND INTERSTITIAL WATERS OF SOME MASSACHUSETTS NORTH SHORE SALT-MARSHES. Massachusetts Univ., Amherst.

R. L. Merrow, and N. H. Nickerson. Available from the National Technical Information Service, Springfield, Va. 22161 as PB-251 551 \$3.50 in paper copy, \$2.25 in microfiche. Completion Report, April 1975, 7 p, 10 ref. OWRT A-036-MASS(1).

Descriptors: *Salinity, *Groundwater movement, *Massachusetts, *Salt marshes, *Peat, *Chlorides, Hydrogen sulfide, Gases, Test wells, Water pollution sources, Path of pollutants, *Connate water, Pollutant identification.

The purpose was to determine whether selected salt marshes along the north shore of Massachusetts had any effect on retarding seaward flow of fresh ground water. The salt marshes on the North Shore are underlain mostly by loose silty peat smelling strongly of H₂S; below the peat at different depths is found dense Boston Blue Clay. Both these soils are semipervious to impervi-

ous to water. Water samples from holes drilled in the marsh showed much variation in chloride content. The evidence indicated that ground water is slowed and to a measurable extent physically backed up by peat deposits in marshes over heavy clay as are found on the North Shore. These findings may be interpreted as evidence that where an impermeable or hard-pan layer occurs under a salt marsh, fresh ground-waters move seaward through the peats of the marsh only slowly, and that any natural openings such as cracks or man-made openings such as mosquito control ditches hasten this run-off. Slow water movement through the peat is amply demonstrated by the presence of H₂S in unmistakable quantity; the anaerobic condition marked by the presence of this gas means no rapid penetration of oxygenated waters. W76-06158

NITROGEN, PHOSPHORUS AND CARBON FLUX IN CHESAPEAKE BAY MARSHES. Virginia Inst. of Marine Science, Gloucester Point. For primary bibliographic entry see Field 5C. W76-06162

REGIONAL DISTRIBUTION OF THE MAJOR DISSOLVED SOLIDS IN THE STREAMS OF ILLINOIS.

Northern Illinois Univ., De Kalb. Dept. of Geology. M. M. Nienkerk, and R. C. Flenal. Available from the National Technical Information Service, Springfield, Va. 22161, as PB-251 554, \$4.50 in paper copy, \$2.25 in microfiche. Illinois Water Resources Center, Urbana, Research Report No. 109, February 1976. 56 p, 34 fig, 4 tab, 21 ref, 3 append. S-046-ILL.

Descriptors: *Dissolved solids, *Illinois, Streams, *Water analysis, *Distribution, *Regional analysis, *Path of pollutants, *Distribution patterns, *Water pollution sources, Strip mining, Wastes, Waste disposal, *Chemical wastes, Drainage basins.

Identifiers: *Stream water quality.

Using water analyses from 67 gaged streams in Illinois, the frequency-weighted mean concentration (mg/l) and the long-term yield (tons/sq mi/yr) were determined for the following dissolved constituents: iron, manganese, fluoride, boron, silica, phosphate, chloride, sulfate, nitrate, ammonium, calcium, magnesium, sodium, potassium, strontium, carbonate, alkalinity, total hardness, and total dissolved mineral content. Values obtained were used to construct contour maps of the magnitudes of each constituent. Most of the constituents are readily contoured, indicating that their magnitudes have regional consistencies, and are controlled by regional rather than local factors. Several constituents (phosphate, ammonium, potassium, and strontium) do not follow this pattern, and at least two (chloride and nitrate) have increased in magnitude with time. Constituents with strong regional patterns can be divided into groups based on the geographic location of high and low concentration/yield areas. In most cases explanations for the patterns can be found in regional patterns of geologic, hydrologic, and/or demographic conditions. Detailed and specific sources for individual constituents are difficult to delimit at this level of investigation. However, general considerations as to the relative importance of natural versus anthropogenic sources can be hypothesized in some of the more apparent cases. Among significant anthropogenic sources appear to be strip mining activity, introduction into—and subsequent fallout from—the atmosphere of soluble materials, use of fertilizers, disposal of industrial, domestic, and farm wastes, and street salting. W76-06163

INFILTRATION OF ORGANIC PHOSPHATE COMPOUNDS IN SOIL. California Univ., Davis. Dept. of Land, Air, and Water Resources.

D. E. Rolston, R. S. Rauschkolb, and D. L. Hoffman.

Soil Science Society of America Proceedings, Vol. 39, No. 6, p 1089-1094, November-December 1975. 6 fig, 19 ref.

Descriptors: *Infiltration, *Irrigation practices, *Soil types, *Fertilizers, *Phosphorus compounds, Leachate, Groundwater movement, Penetration, Soil properties, Phosphates, Nutrient removal, Phosphorus, Soil analysis, Evaluation, Soil chemistry, Soil bacteria, Soil moisture, Soil water, Organic compounds, Clay loam.

Identifiers: Organic phosphate compounds, Chemical fertilizers, Phosphorus placement, *Phosphorus fertilizers, Phosphatase enzyme, Panoche clay loam, Aiken clay loam, Glycerophosphate, Methyl ester phosphate, Glycol phosphate, Infiltrating solutions.

Organic phosphate compounds may be moved greater distances into soil than is possible with inorganic phosphates, inasmuch as organic phosphates must be enzymatically hydrolyzed to orthophosphate before soil reactions inhibit movement. The hydrolysis in solution and movement in soil of six organic phosphates were investigated in order to evaluate possible advantages of the compounds as fertilizers. The compounds studied were glycerophosphate, methyl ester phosphate, glycol phosphate, glycol phosphate, ethyl ester phosphate, glucose 1-phosphate, and glucose 6-phosphate. The infiltration of organic P compounds into Panoche clay loam soil and glycerophosphate into five soils differing in texture, clay type, organic matter, and pH and into one soil at three water contents was investigated by infiltrating organic P solution into columns of dry or moist soil at a rate of 66 kg of P/ha. Inorganic P concentration in bicarbonate extracts was measured as a function of soil depth at the termination of infiltration. The movement of P from organic compounds was compared with the movement of potassium phosphate. All the organic phosphates hydrolyzed at similar rates. The P from all the organic compounds moved to approximately the 12-cm depth in the calcareous Panoche clay loam soil with only slight differences in P concentration above that depth, whereas inorganic phosphate moved no more than 2-3 cm. The enzymatic hydrolysis rate of glycerophosphate and the resulting P distribution after infiltration was influenced by soil type. (Henley - ISWS) W76-06170

LATERAL LOSS OF PICLORAM AND 2,4-D FROM A FOREST PODSOL DURING RAINSTORMS.

Guelph Univ. (Ontario). Dept. of Botany and Genetics. R. Suffling, D. W. Smith, and G. Sirons. Weed Res. Vol 14, No. 5, p 301-304. 1974. Illus.

Descriptors: *2,4-D, Podsoles, Rain, Great Lakes, Forests, Canada, Herbicides, Clear-cutting.

Identifiers: *Picloram.

Losses of picloram (4-amino-3,5,6-trichloropicolinic acid as the triisopropanolamine salt) and 2,4-D (as the triisopropanolamine salt) from a Tordon 101-sprayed podsol in a Great Lakes (Canada) forest clearcut were measured for 1 yr following spraying. Less than 1.0% of the picloram and much less than 0.1% of the 2,4-D applied was lost during 7 runoff events. Even an event less than 24 h after spraying failed to release significant quantities of either herbicide.—Copyright 1975, Biological Abstracts, Inc. W76-06197

FORMULATION AND USE OF PRACTICAL MODELS FOR RIVER QUALITY ASSESSMENT.

Geological Survey, Portland, Oreg. Water Resources Div. For primary bibliographic entry see Field 5G. W76-06209

Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

Group 5B—Sources Of Pollution

A COMPARATIVE STUDY OF CHEMICAL LOADINGS OF ACID AND NON-ACID TRIBUTARIES OF CHEAT LAKE, WEST VIRGINIA.
West Virginia Univ., Morgantown. Dept. of Biology.
D. Edens.
Proceedings West Virginia Academy of Science, Vol. 1, p. 45-51, 1974. 4 tab., 14 ref.

Descriptors: *Chemical analysis, *Acid mine drainage, *Acid streams, *West Virginia, Discharge measurement, Hydrogen ion concentration, Specific conductivity, Silicates, Sulfates, Iron, Acidity, Phosphates, Nitrates, Nitrogen, Ions, Cations, Potassium, Surveys, Tributaries.
Identifiers: *Cheat Lake(W Va), Canyon Run(W Va), Sunnyside Run(W Va), Tower Run(W Va), Maple Run(W Va), Morgan Run(W Va), Cole's Run(W Va), Quarry Run(W Va), Rubles Run(W Va).

Acid stream loading was compared with non-acid stream loading in tributaries of Cheat Lake, West Virginia, using concentration and discharge measurements taken during June 1973-January 1974. Acid streams had low pH, high conductivity, high silicate, sulfate, total iron, total acidity, orthophosphate, and total phosphate concentrations, and low nitrate-nitrogen concentrations. Non-acid streams had a pH near neutrality, lower conductivity, and lower silicate, sulfate, total iron, total acidity, orthophosphate, and total phosphate concentrations. Acid streams had high loadings of sulfate, total iron, total acidity, orthophosphate, and total phosphate, lower nitrate-nitrogen loading, and contributed more ions to Cheat Lake. Acid mine drainage did not increase silicate loading. Streams receiving acid drainage had higher cation concentrations, except potassium, and greater ion concentrations and loadings per unit drainage area. Acid tributaries could be distinguished from non-acid tributaries by all parameters studied except nitrate-nitrogen concentration and loading, silicate loading, and potassium concentration. Maple Run and Quarry Run had been disturbed and were distinguished from other non-acid streams by drainage area concentrations and loadings. Loadings and concentrations per unit drainage area detect small differences in streams and may indicate disturbances in drainage basins undetected by concentrations or loadings alone. (Buchanan-Davidson--Wisconsin).

W76-06213

ECOLOGY AND BIOGEOGRAPHY OF MAYFLIES (EPHEMEROPTERA) OF RUNNING WATERS IN THE POLISH PART OF THE CARPATHIANS. I. DISTRIBUTION AND QUANTITATIVE ANALYSIS.
Jagellonian Univ., Krakow (Poland). Dept. of Hydrobiology.
For primary bibliographic entry see Field 5C.
W76-06216

BIODETERIORATION OF NAVY INSECTICIDES IN THE OCEAN.
Civil Engineering Lab. (Navy). Port Hueneme, Calif.
H. P. Vind, and C. W. Mathews.
Available from the National Technical Information Service, Springfield, Va. 22161 as AD/A007 568 \$3.50 in paper copy, \$2.25 in microfiche. ONR Annual Report No. 4, January 1975. 13 p, 2 tab., 1 ref. ONR 1-0020.

Descriptors: *Biodegradation, *Insecticides, *Sea water, DDT, Chlorinated hydrocarbon pesticides, Microorganisms, Lepids, Solubility, Pesticide residues, Toxicity, Leaching, Laboratory tests, Water pollution control.
Identifiers: Limnoria tripunctata.

Based on previous studies concerning the biodegradation of insecticides in the ocean, it was hypothesized that water insoluble chlorinated insecticides are transported in sea water primarily

by being absorbed in the fatty cell membranes of microorganisms suspended in the water. According to the hypothesis, it is theorized that insecticides which are somewhat less fat soluble than DDT will not enter marine food chains as easily as DDT. Thus they would be less hazardous as DDT, but would be just as toxic and persistent. It is predicted that insecticides in sewage can be removed with microbial cells in a primary or secondary sewage treatment plant. To determine the validity of this hypothesis, matchsticks are impregnated with a chlorinated hydrocarbon insecticide or other chlorinated compound, then tested to see if the chlorine-containing compounds are degraded or leached. The wood eating marine crustacean, Limnoria tripunctata, is used as the test organism. Also gas chromatography will be used to determine the presence of insecticides. Early tests have been inconclusive, because leaching is very slow. Relative rates of biodegradation, fat solubilities, and leaching of 26 different chlorinated organic insecticides or related chlorinated compounds are being tested. (Buchanan-Davidson--Wisconsin)

W76-06219

EFFECT OF PHOSPHORUS AND SULPHURSPHATES ON MOVEMENT OF PHOSPHORUS AND SULPHUR IN TWO SOILS.
New Zealand Fertilizer Manufacturers Research Association, Inc., Papatoetoe.
For primary bibliographic entry see Field 2G.
W76-06242

VIBRIO PARAHAEOLYTICUS IN SEA-WATER OFF THE PACIFIC COAST OF PANAMA.
Gorgas Memorial Lab., Balboa Heights, Canal Zone.
For primary bibliographic entry see Field 2L.
W76-06252

N AND P DISTRIBUTION IN LAKE KINNERET (ISRAEL) WITH EMPHASIS ON DISSOLVED ORGANIC NITROGEN.
Israel Oceanographic and Limnological Research Ltd., Haifa, and Kinneret Limnology Lab., Tiberias (Israel).
C. Serruya, U. Pollinger, and M. Gophen.
Oikos, Vol. 26, No. 1, p. 1-8, 1975. 7 fig, 4 tab, 26 ref.

Descriptors: *Nitrogen, *Phosphorus, *Nitrogen cycle, *Lake sediments, *Lake stages, Lakes, Ammonia, Nitrates, Denitrification, Ammonification, Nitrogen compounds, Bottom sediments, Eutrophication, Limnology, Plankton, Anaerobic conditions.
Identifiers: *Dissolved organic nitrogen, *Lake Kinneret (Israel), Peridinium.

Fluctuations of the amounts of different forms of nitrogen and total phosphorus, and their distribution between lake water and plankton in Lake Kinneret in northern Israel are described. Distribution of N and P shows that the lake water is the largest pool of N while sediments are the main reservoir of P. The organic nitrogen originates from 3 sources: the watershed, the plankton and the sediments. During the 7-8 month anoxic period, a large amount of organic nitrogen is accumulated in the lake bottom. During the destratification and turnover period this deposited organic nitrogen undergoes rapid hydrolysis and causes a sudden increase in dissolved organic nitrogen. The rate of ammonification of the dissolved organic nitrogen in winter may have an important ecological role, as a delay may retard the Peridinium bloom. (Robinet-Arizona)

W76-06268

DEVELOPMENT OF AN ECONOMIC/ENVIRONMENTAL PLAN FOR DENTS RUN WATERSHED, WEST VIRGINIA.
Halliburton Services, Duncan, Okla.
For primary bibliographic entry see Field 5G.

W76-06270

HORIZONTAL SPREAD OF WASTEWATER FIELD OVER CALM OCEAN SURFACE.
Montgomery (James M.), Pasadena, Calif.
J. L. Chao.

Journal Water Pollution Control Federation, Vol. 47, No. 10, p. 2504-2510, October, 1975. 2 fig, 18 ref.

Descriptors: *Waste assimilative capacity, *Waste water disposal, *Oceans, *Effluents, Design criteria, Engineering, Water pollution effects, Pollutant identification, Flow characteristics, *Path of pollutants.

Discharge of waste water into the ocean by cities and industries demands effective dilution of the effluent for oxidation and assimilation of the waste. Because of the complexity of ocean outfall system designs, the problem of horizontal spread of waste water in the absence of ocean currents was analyzed, and design guidelines were established for the practicing engineer. Since the primary purpose of the paper was to provide a simple method for estimating the dilution resulting from horizontal spread, flow characteristics were simplified and assumptions were made. It was pointed out that the subsequent dilution resulting from horizontal spread is relatively low in magnitude in comparison with the initial dilution that the effluent buoyant plume receives. (Loustau-FIRL)

W76-06294

CHLORINATION IN DILUTE AQUEOUS SYSTEMS; 2,4,6-TRICHLOROPHENOL.
Waterloo Univ. (Ontario). Dept. of Chemistry.
J. G. Smith, S. Lee, and A. Netzer.
Environmental Letters, Vol. 10, No. 1, p. 47-52, 1975. 1 tab. 10 ref.

Descriptors: *Chlorination, *Chemical reactions, *Phenols, Analytical techniques, Pollutant identification, Water pollution sources.
Identifiers: Chloroform.

In order to elucidate the effects of chloroform on phenols, 2,4,6-trichlorophenol in dilute aqueous solution was treated with hypochlorous acid at pH 3.5 to pH 6. Reaction products were extracted from solution and examined by thin layer chromatography. The individual isolated components were characterized by their infra-red, nmr, and mass spectra. The principal products of the reaction were 2,4,6-tetrachloro-2,5-cyclohexadienone (A), and 2,6-dichloro-p-benzoquinone (B). Their identification was based on their spectra and was confirmed by mixture melting point with authentic samples. The possibility of the interconversion of A and B was investigated by treating each of these compounds with hypochlorous acid, but it did not occur. Instead, an unidentified material characterized by a carbonyl frequency at 1800 cm was formed. A number of minor products were also formed. The material balance in the experiments was low, with approximately 50% of the organic material remaining in the aqueous layer or being lost by volatilization. Recovery of the organic products from the chromatographic column was also low. In part, this loss appears due to photolytically induced decomposition of the chlorinated products. Hypochlorous acid produces non-phenolic products by oxidation and by the addition of chlorine and/or hypochlorous acid to the aromatic ring. Although the toxicological properties of these polychlorinated species are unknown, chemical separations of chlorination reaction products should be employed with caution. (Loustau-FIRL)

W76-06306

PHOSPHATE SORPTION CHARACTERISTICS OF SOILS TREATED WITH DOMESTIC WASTE WATER,

Connecticut Agricultural Experiment Station, New Haven.
B. L. Sawhney, and D. E. Hill.
Journal of Environmental Quality, Vol. 4, No. 3, p 342-346, July/September, 1975. 5 fig, 4 tab, 14 ref.

Descriptors: *Nutrient removal, *Soils, *Phosphates, *Sorption, Laboratory tests, Septic tanks, Soil mechanics, Waste water treatment, Environmental effects.
Identifiers: Soil saturation.

The capabilities of six widely different Connecticut soils to sorb phosphate was studied in laboratory tests. Samples of the soils were suspended in phosphate solutions and their saturation times were measured. With that information the traveling time of the phosphate in the soils was calculated. Soil cores of the six soils were then leached with phosphate solutions on a weekly basis for two years. It was found that because of the great variance in sorption capacities, the saturation time requirements varied greatly. Over time the soils did not become fully saturated, suggesting that the soils were regenerated. These observations were substantiated by field studies around septic tank drainfields, one of which had been in operation for 15 years and still showed sorption capabilities. In addition, treatment of acid soils with waste water was found to increase their pH, thereby increasing their CEC and capacity to remove cationic pollutants from waste water. Thus it was concluded that soils around septic tank systems can remove phosphate effectively and for an indefinite length of time. (Loustau-FIRL)
W76-06330

EFFECT OF SEWAGE SLUDGE ON SOME SOIL PHYSICAL PROPERTIES,

Agricultural Research Service, Beltsville, Md.
Agricultural Environmental Quality Inst.
For primary bibliographic entry see Field 5E.
W76-06331

TRACE ELEMENT CONCENTRATIONS OF SEWAGE TREATMENT PLANT EFFLUENTS AND SLUDGES; THEIR INTERACTIONS WITH SOILS AND UPTAKE BY PLANTS,

California Univ., Riverside. Dept. of Soil Science and Agricultural Engineering.
G. R. Bradford, A. L. Page, L. J. Lund, and W. Olmstead.

Journal of Environmental Quality, Vol. 4, No. 1, p 123-217, January/March, 1975. 1 fig, 8 tab, 18 ref.

Descriptors: *Sludge disposal, *Trace elements, Soil contamination effects, Treatment facilities, Effluents, California soil analysis, Toxicity, Water pollution effects, Waste water(Pollution).
Identifiers: Sludge toxicity.

The variety and concentrations of trace elements in effluents and sludges from certain metropolitan areas were identified and their interactions with soils and effects on plant growth were evaluated. Seven secondary treatment plants in southern California were selected for bimonthly analyses of the effluent over a 10-month period. The concentrations of Cu, Zn, Ni, Co, and Cd were consistently higher in the sludge samples than those obtained in ordinary California soils. Analysis of barley, bean, and tomato plants grown in sand culture and irrigated with aqueous sludge extracts was done to demonstrate the variability of absorption of different elements from sludge sources. Excessive and often toxic concentrations of B, Cu, Mo, Ni, Co, and Cd were found when compared to the concentrations in the control plants irrigated with a complete nutrient solution. Variabilities of different elements from different sludge are presented in a table. (Loustau-FIRL)
W76-06332

REVIEW OF HEATED DISCHARGE MANAGEMENT AND CONTROL ALTERNATIVES, ONCE-THROUGH SYSTEMS IN LARGE WATER BODIES.

MacLaren (James F.) Ltd., Willowdale (Ontario).
Environmental Protection Service, Environment Canada, Ottawa, Canada. Economic and Technical Review Report EPS 3-WP-75-4, December 1975, 161 p., 14 fig, 12 tab, 214 ref.

Descriptors: *Thermal powerplants, *Temperature control, Powerplants, Intakes, Environmental effects, *Reviews, *Thermal pollution.
Identifiers: *Heated discharges, Cooling systems.

A review is presented of current literature and non-Canadian legislation dealing with heated discharges from thermal power plants. Management and control alternatives are discussed, with particular reference to the problems associated with once-through cooling systems discharging into large water bodies. Topics discussed include the environmental effects of cooling systems, alternative designs for intakes and cooling systems, methods for the prediction and monitoring of environmental effects of heated discharges, and research needs. Past and existing standards and regulations for temperature control in other countries are critically reviewed. Recommendations are made concerning the selection of power plant sites, pre-operational surveys, the development of criteria for heated discharge regulation, intake and outfall design, and alternative cooling systems. (Environment Canada)
W76-06372

A MODEL TO PREDICT THE PERFORMANCE OF FEEDLOT RUNOFF CONTROL FACILITIES AT SPECIFIC OREGON LOCATIONS,

Oregon State Univ., Corvallis. Dept. of Agricultural Engineering.
R. B. Wessink, and J. R. Miner.
Transactions of the American Society of Agricultural Engineers, Vol. 18, No. 6, p 1141-1146, November-December 1975. 3 fig, 6 tab, 6 ref.
OWRT A-028-ORE(Z) EPA R-803819-01-0.

Descriptors: *Model studies, *Storm runoff, *Agricultural runoff, *Weather data, *Farm wastes, *Oregon, Water pollution sources, *Feed lots, Detention reservoirs, Water pollution control, Organic wastes, Rainfall-runoff relationships, Precipitation(Atmospheric).
Identifiers: Runoff curve number, Sufficient design method.

A computer simulation model was developed which can be used to size feedlot runoff retention basins based upon previous climatological records. The model simulated a feedlot surface onto which precipitation falls and runoff results. Weather data from three unique climatological regions were used in the model to evaluate feedlot pollution control designs in Oregon. The sufficient design method was used to determine minimum storage volume required to prevent illegal discharges as defined by EPA Effluent Guidelines. This technique demonstrated that to use design procedures based upon a factor times the 10 yr-24 hr or the 25 yr-24 hr storm leads to designs that are either unreasonably expensive or would lead to illegal discharges. The model was used to determine pollution control performance with various combinations of pumping rates and storage facility volumes. (Lardner - ISWS)
W76-06382

WASTEWATER DISPOSAL BY SUBMERGED MANIFOLDS,

Miljøplan, Hovik (Norway). Water Pollution Section.
P. Liseth.
Journal of Hydraulics Division, American Society of Civil Engineers, Vol. 102, No. HY1, Proceedings Paper 11839, p 1-14, January 1976. 8 fig, 13 ref, 1 append.

Descriptors: *Path of pollutants, *Hydraulic design, *Hydraulic models, *Hydraulic structures, *Outlet works, Outlets, Outfall sewers, Diffusion, Waste dilution, Discharge(Water), Orifices, Hydraulics, *Waste water disposal, Laboratory tests, Mixing.
Identifiers: Manifolds, *Submerged orifices, Diffusers, Submerged manifold.

Jet mixing from submerged manifolds for waste-water disposal was studied by means of hydraulic model experiments. The experimental results showed that the dilution and flow pattern of buoyant jets from a manifold in stagnant receiving water of uniform density is altered if merging of the jets takes place. The ratio between vertical distance y above the manifold to the distance L between the ports along the manifold was found to be determining for the effects of merging. For values of y/L between 0.5, no significant differences in the center dilution was observed as compared to that of a single jet. For y/L greater than 5, the jets gradually merged into a two-dimensional plume over the manifold, causing a rapid reduction in the center dilution. For a given discharge load per length of manifold a port spacing y/L from 5 to 10 will result in the highest center dilution of the jets. (Morris-ISWS)
W76-06387

THE SALINITY EFFECT IN A MIXED LAYER OCEAN MODEL,

National Aeronautics and Space Administration, New York. Goddard Inst. for Space Studies.
For primary bibliographic entry see Field 2L.
W76-06393

NITRATE MOVEMENT AND ITS DISTRIBUTION IN THE SOIL PROFILE OF DIFFERENTIALLY FERTILIZED CORN WATERSHEDS,

Agricultural Research Service, Cheyenne, Wyo.
G. E. Schuman, T. M. McCalla, K. E. Saxton, and H. T. Knox.
Soil Science Society of America Proceedings, Vol. 39, No. 6, p 1192-1197, November-December 1975. 4 fig, 2 tab, 20 ref.

Descriptors: *Nitrates, *Fertilizers, *Soil profiles, *Soil water movement, *Ion transport, *Iowa, Analytical techniques, Inorganic compounds, Leaching, Nutrient removal, Water pollution sources, Path of pollutants, Water quality, Nitrogen, Soil analysis, Irrigation effects, Soil tests, Percolation, Groundwater, Root zone, Agriculture, Loess, Contour farming, Corn(Field), Agricultural watersheds.
Identifiers: Nitrate movement, Chemical fertilizers, Anhydrous ammonia, Ammonia nitrate.

Nitrate movement within the 6.1-m soil profile of a watershed in southwestern Iowa, fertilized at 448 kg N/ha per yr, resulted in a 720-kg/ha increase in NO₃-N below the corn root zone during the 3-year study. The NO₃-N concentration of the baseflow from the watershed increased during this period, indicating that some of the leached NO₃-N reached the groundwater. The watershed fertilized at the recommended N rate (168 kg/ha per yr) did not increase the quantity of NO₃-N below the corn root zone; however, some NO₃-N leaching did occur. Between April 1971 and April 1974, the accumulation of NO₃-N in the profile of the excessively fertilized watershed moved from the 1.0- to 3.1-m depth. The watershed fertilized with 168 kg N/ha per yr did not show any zones of significant NO₃-N accumulation in the soil profile at any of the sampling dates. The depth to the water table on the lowest contour sampled on the excessively fertilized watershed was 4.6 and 4.9 m in April 1973, and April 1974, respectively. The average NO₃-N concentration for these two sampling dates at the water table depth increased from 3.7 to 12.9 ppm. The average NO₃-N concentration at the water table depth on the normally fertilized watershed was 2.0 and 4.5 ppm in April 1973 and April 1974,

Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

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Descriptors: *Chemical analysis, *Acid mine drainage, *Acid streams, *West Virginia, Discharge measurement, Hydrogen ion concentration, Specific conductivity, Silicates, Sulfates, Iron, Acidity, Phosphates, Nitrates, Nitrogen, Ions, Cations, Potassium, Surveys, Tributaries.
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Civil Engineering Lab. (Navy). Port Hueneme, Calif.
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New Zealand Fertilizer Manufacturers Research Association, Inc., Papatetoe.
For primary bibliographic entry see Field 2G.
W76-06242

VIBRIO PARAHAEOLYTICUS IN SEAWATER OFF THE PACIFIC COAST OF PANAMA.
Gorgas Memorial Lab., Balboa Heights, Canal Zone.
For primary bibliographic entry see Field 2L.
W76-06252

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C. Serruya, U. Pollinger, and M. Gophen.
Oikos, Vol. 26, No. 1, p. 1-8, 1975. 7 fig, 4 tab, 26 ref.

Descriptors: *Nitrogen, *Phosphorus, *Nitrogen cycle, *Lake sediments, *Lake stages, Lakes, Ammonia, Nitrates, Denitrification, Ammonification, Nitrogen compounds, Bottom sediments, Eutrophication, Limnology, Plankton, Anaerobic conditions.
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Montgomery (James M.), Pasadena, Calif.
J. L. Chao.

Journal Water Pollution Control Federation, Vol. 47, No. 10, p. 2504-2510, October, 1975. 2 fig, 18 ref.

Descriptors: *Waste assimilative capacity, *Waste water disposal, *Oceans, *Effluents, Design criteria, Engineering, Water pollution effects, Pollutant identification, Flow characteristics, *Path of pollutants.

Discharge of waste water into the ocean by cities and industries demands effective dilution of the effluent for oxidation and assimilation of the waste. Because of the complexity of ocean outfall system designs, the problem of horizontal spread of waste water in the absence of ocean currents was analyzed, and design guidelines were established for the practicing engineer. Since the primary purpose of the paper was to provide a simple method for estimating the dilution resulting from horizontal spread, flow characteristics were simplified and assumptions were made. It was pointed out that the subsequent dilution resulting from horizontal spread is relatively low in magnitude in comparison with the initial dilution that the effluent buoyant plume receives. (Loustau-FIRL)
W76-06294

CHLORINATION IN DILUTE AQUEOUS SYSTEMS; 2,4,6-TRICHLOROPHENOL.
Waterloo Univ. (Ontario). Dept. of Chemistry.
J. G. Smith, S. Lee, and A. Netzer.
Environmental Letters, Vol. 10, No. 1, p. 47-52, 1975. 1 tab. 10 ref.

Descriptors: *Chlorination, *Chemical reactions, *Phenols, Analytical techniques, Pollutant identification, Water pollution sources.
Identifiers: Chloroform.

In order to elucidate the effects of chloroform on phenols, 2,4,6-trichlorophenol in dilute aqueous solution was treated with hypochlorous acid at pH 3.5 to pH 6. Reaction products were extracted from solution and examined by thin layer chromatography. The individual isolated components were characterized by their infra-red, nmr, and mass spectra. The principal products of the reaction were 2,4,4,6-tetrachloro-2,5-cyclohexadienone (A), and 2,6-dichloro-p-benzoquinone (B). Their identification was based on their spectra and was confirmed by mixture melting point with authentic samples. The possibility of the interconversion of A and B was investigated by treating each of these compounds with hypochlorous acid, but it did not occur. Instead, an unidentified material characterized by a carbonyl frequency at 1800 cm⁻¹ was formed. A number of minor products were also formed. The material balance in the experiments was low, with approximately 50% of the organic material remaining in the aqueous layer or being lost by volatilization. Recovery of the organic products from the chromatographic column was also low. In part, this loss appears due to photolytically induced decomposition of the chlorinated products. Hypochlorous acid produces non-phenolic products by oxidation and by the addition of chlorine and/or hypochlorous acid to the aromatic ring. Although the toxicological properties of these polychlorinated species are unknown, chemical separations of chlorination reaction products should be employed with caution. (Loustau-FIRL)
W76-06306

PHOSPHATE SORPTION CHARACTERISTICS OF SOILS TREATED WITH DOMESTIC WASTE WATER.

Connecticut Agricultural Experiment Station, New Haven.

B. L. Sawhney, and D. E. Hill.

Journal of Environmental Quality, Vol. 4, No. 3, p 342-346, July/September, 1975. 5 fig, 4 tab, 14 ref.

Descriptors: *Nutrient removal, *Soils, *Phosphates, *Sorption, Laboratory tests, Septic tanks, Soil mechanics, Waste water treatment, Environmental effects.
Identifiers: Soil saturation.

The capabilities of six widely different Connecticut soils to sorb phosphate was studied in laboratory tests. Samples of the soils were suspended in phosphate solutions and their saturation times were measured. With that information the traveling time of the phosphate in the soils was calculated. Soil cores of the six soils were then leached with phosphate solutions on a weekly basis for two years. It was found that because of the great variance in sorption capacities, the saturation time requirements varied greatly. Over time the soils did not become fully saturated, suggesting that the soils were regenerated. These observations were substantiated by field studies around septic tank drainfields, one of which had been in operation for 15 years and still showed sorption capabilities. In addition, treatment of acid soils with waste water was found to increase their pH, thereby increasing their CEC and capacity to remove cationic pollutants from waste water. Thus it was concluded that soils around septic tank systems can remove phosphate effectively and for an indefinite length of time. (Loustau-FIRL)

W76-06330

EFFECT OF SEWAGE SLUDGE ON SOME SOIL PHYSICAL PROPERTIES.

Agricultural Research Service, Beltsville, Md. Agricultural Environmental Quality Inst.

For primary bibliographic entry see Field 5E.

W76-06331

TRACE ELEMENT CONCENTRATIONS OF SEWAGE TREATMENT PLANT EFFLUENTS AND SLUDGES; THEIR INTERACTIONS WITH SOILS AND UPTAKE BY PLANTS.

California Univ., Riverside. Dept. of Soil Science and Agricultural Engineering.

G. R. Bradford, A. L. Page, L. J. Lund, and W. Olmstead.

Journal of Environmental Quality, Vol. 4, No. 1, p 123-217, January/March, 1975. 1 fig, 8 tab, 18 ref.

Descriptors: *Sludge disposal, *Trace elements, Soil contamination effects, Treatment facilities, Effluents, California soil analysis, Toxicity, Water pollution effects, Waste water(Pollution).
Identifiers: Sludge toxicity.

The variety and concentrations of trace elements in effluents and sludges from certain metropolitan areas were identified and their interactions with soils and effects on plant growth were evaluated. Seven secondary treatment plants in southern California were selected for bimonthly analyses of the effluent over a 10-month period. The concentrations of Cu, Zn, Ni, Co, and Cd were consistently higher in the sludge samples than those obtained in ordinary California soils. Analysis of barley, bean, and tomato plants grown in sand culture and irrigated with aqueous sludge extracts was done to demonstrate the variability of absorption of different elements from sludge sources. Excessive and often toxic concentrations of B, Cu, Mo, Ni, Co, and Cd were found when compared to the concentrations in the control plants irrigated with a complete nutrient solution. Variabilities of different elements from different sludge are presented in a table. (Loustau-FIRL)

W76-06332

REVIEW OF HEATED DISCHARGE MANAGEMENT AND CONTROL ALTERNATIVES, ONCE-THROUGH SYSTEMS IN LARGE WATER BODIES.

MacLaren (James F.) Ltd., Willowdale (Ontario).

Environmental Protection Service, Environment Canada, Ottawa, Canada, Economic and Technical Review Report EPS 3-WP-75-4, December 1975, 161 p., 14 fig, 12 tab, 214 ref.

Descriptors: *Thermal powerplants, *Temperature control, Powerplants, Intakes, Environmental effects, *Reviews, *Thermal pollution.
Identifiers: *Heated discharges, Cooling systems.

A review is presented of current literature and non-Canadian legislation dealing with heated discharges from thermal power plants. Management and control alternatives are discussed, with particular reference to the problems associated with once-through cooling systems discharging into large water bodies. Topics discussed include the environmental effects of cooling systems, alternative designs for intakes and cooling systems, methods for the prediction and monitoring of environmental effects of heated discharges, and research needs. Past and existing standards and regulations for temperature control in other countries are critically reviewed. Recommendations are made concerning the selection of power plant sites, pre-operational surveys, the development of criteria for heated discharge regulation, intake and outfall design, and alternative cooling systems. (Environment Canada)

W76-06372

A MODEL TO PREDICT THE PERFORMANCE OF FEEDLOT RUNOFF CONTROL FACILITIES AT SPECIFIC OREGON LOCATIONS.

Oregon State Univ., Corvallis. Dept. of Agricultural Engineering.

R. B. Wensink, and J. R. Miner.

Transactions of the American Society of Agricultural Engineers, Vol. 18, No. 6, p 1141-1146, November-December 1975. 3 fig, 6 tab, 6 ref. OWRT A-028-ORE(Z) EPA R-803819-01-0.

Descriptors: *Model studies, *Storm runoff, *Agricultural runoff, *Weather data, *Farm wastes, *Oregon, Water pollution sources, *Feed lots, Detention reservoirs, Water pollution control, Organic wastes, Rainfall-runoff relationships, Precipitation(Atmospheric).
Identifiers: Runoff curve number, Sufficient design method.

A computer simulation model was developed which can be used to size feedlot runoff retention basins based upon previous climatological records. The model simulated a feedlot surface onto which precipitation falls and runoff results. Weather data from three unique climatological regions were used in the model to evaluate feedlot pollution control designs in Oregon. The sufficient design method was used to determine minimum storage volume required to prevent illegal discharges as defined by EPA Effluent Guidelines. This technique demonstrated that to use design procedures based upon a factor times the 10 yr-24 hr or the 25 yr-24 hr storm leads to designs that are either unreasonably expensive or would lead to illegal discharges. The model was used to determine pollution control performance with various combinations of pumping rates and storage facility volumes. (Lardner - ISWS)

W76-06382

WASTEWATER DISPOSAL BY SUBMERGED MANIFOLDS.

Miljøplan, Hovik (Norway). Water Pollution Section.

P. Liseth.

Journal of Hydraulics Division, American Society of Civil Engineers, Vol. 102, No. HY1, Proceedings Paper 11839, p 1-14, January 1976. 8 fig, 13 ref, 1 append.

Descriptors: *Path of pollutants, *Hydraulic design, *Hydraulic models, *Hydraulic structures, *Outlet works, Outlets, Outfall sewers, Diffusion, Waste dilution, Discharge(Water), Orifices, Hydraulics, *Waste water disposal, Laboratory tests, Mixing.

Identifiers: Manifolds, *Submerged orifices, Diffusers, Submerged manifold.

Jet mixing from submerged manifolds for wastewater disposal was studied by means of hydraulic model experiments. The experimental results showed that the dilution and flow pattern of buoyant jets from a manifold in stagnant receiving water of uniform density is altered if merging of the jets takes place. The ratio between vertical distance y above the manifold to the distance L between the ports along the manifold was found to be determining for the effects of merging. For values of y/L between 0.5, no significant differences in the center dilution was observed as compared to that of a single jet. For y/L greater than 5, the jets gradually merged into a two-dimensional plume over the manifold, causing a rapid reduction in the center dilution. For a given discharge load per length of manifold a port spacing y/L from 5 to 10 will result in the highest center dilution of the jets. (Morris-ISWS)

W76-06387

THE SALINITY EFFECT IN A MIXED LAYER OCEAN MODEL.

National Aeronautics and Space Administration, New York. Goddard Inst. for Space Studies.

For primary bibliographic entry see Field 2L.

W76-06393

NITRATE MOVEMENT AND ITS DISTRIBUTION IN THE SOIL PROFILE OF DIFFERENTIALLY FERTILIZED CORN WATERSHEDS.

Agricultural Research Service, Cheyenne, Wyo.

G. E. Schuman, T. M. McCalla, K. E. Saxton, and H. T. Knox.

Soil Science Society of America Proceedings, Vol. 39, No. 6, p 1192-1197, November-December 1975. 4 fig, 2 tab, 20 ref.

Descriptors: *Nitrates, *Fertilizers, *Soil profiles, *Soil water movement, *Ion transport, *Iowa, Analytical techniques, Inorganic compounds, Leaching, Nutrient removal, Water pollution sources, Path of pollutants, Water quality, Nitrogen, Soil analysis, Irrigation effects, Soil tests, Percolation, Groundwater, Root zone, Agriculture, Loess, Contour farming, Corn(Field), Agricultural watersheds.
Identifiers: Nitrate movement, Chemical fertilizers, Anhydrous ammonia, Ammonia nitrate.

Nitrate movement within the 6.1-m soil profile of a watershed in southwestern Iowa, fertilized at 448 kg N/ha per yr, resulted in a 720-kg/ha increase in NO₃-N below the corn root zone during the 3-year study. The NO₃-N concentration of the baseflow from the watershed increased during this period, indicating that some of the leached NO₃-N reached the groundwater. The watershed fertilized at the recommended N rate (168 kg/ha per yr) did not increase the quantity of NO₃-N below the corn root zone; however, some NO₃-N leaching did occur. Between April 1971 and April 1974, the accumulation of NO₃-N in the profile of the excessively fertilized watershed moved from the 1.0- to 3.1-m depth. The watershed fertilized with 168 kg N/ha per yr did not show any zones of significant NO₃-N accumulation in the soil profile at any of the sampling dates. The depth to the water table on the lowest contour sampled on the excessively fertilized watershed was 4.6 and 4.9 m in April 1973, and April 1974, respectively. The average NO₃-N concentration for these two sampling dates at the water table depth increased from 3.7 to 12.9 ppm. The average NO₃-N concentration at the water table depth on the normally fertilized watershed was 2.0 and 4.5 ppm in April 1973 and April 1974,

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respectively, with a water table depth of 3.0 m. (Healey 11SW5)
W76-06401

THICK BH HORIZONS IN THE NORTH CAROLINA COASTAL PLAIN: II: PHYSICAL AND CHEMICAL PROPERTIES AND RATES OF ORGANIC ADDITIONS FROM SURFACE SOURCES.
Soil Conservation Service, Beltsville, Md.
For primary bibliographic entry see Field 2G.
W76-06403

HYDROTHERMAL CONVECTION IN SATURATED POROUS MEDIA.
Bordeaux-1 Univ., Talence (France).
For primary bibliographic entry see Field 2F.
W76-06415

TRANSIENT WATER QUALITY MODELING IN STREAMS.
Cornell Univ., Ithaca, N.Y. School of Civil and Environmental Engineering.
R. Willis, D. R. Anderson, and J. A. Dracup.
Water Resources Bulletin, Vol. 12, No. 1, p 157-174, February 1976. 4 fig, 1 tab, 17 ref.

Descriptors: *Water quality, *Management, *Simulation analysis, *Nitrogen cycle, Environmental engineering, Planning, Streams, Canals, Dissolved oxygen, Systems analysis, Mathematical models, Equations, *California.
Identifiers: Finite difference approximation, Mass transport equations, *Truckee River(Cal), Transient conditions.

A general planning model for simulation of water quality in streams and canals is formulated and verified. The model simulates the temporal and spatial variations in conservative and nonconservative constituents. The nitrogen cycle and its interaction with other nutrients and the dissolved oxygen resources of the stream are included. A fully implicit finite difference approximation is used to solve the mass transport equations describing variations in constituent concentrations throughout the stream systems. The model is applied to the Truckee River in northern California. Results indicate the applicability of the model for assessing the impact of alternative water quality management strategies on the stream systems. (Bell-Cornell)
W76-06433

GROUND-WATER QUALITY IN SELECTED AREAS SERVED BY SEPTIC TANKS, DADE COUNTY, FLORIDA.
Geological Survey, Tallahassee, Fla.
W. A. J. Pitt, H. C. Matraw, Jr., and H. Klein.
Open-file report 75-607, 1975. 82 p, 24 fig, 11 tab, 25 ref.

Descriptors: *Water pollution sources, *Groundwater, *Septic tanks, *Florida, Observation wells, Water analysis, Path of pollutants, Aquifer characteristics, Groundwater movement, Physical properties, Chemical analysis, Bacteria, Coliforms, Nitrogen, Phosphorus.
Identifiers: *Dade County(Fla).

During 1971-74, the U. S. Geological Survey investigated the chemical, physical, bacteriological, and virological characteristics of the groundwater in five areas serviced by septic tanks in Dade County, Florida. Samples were collected from wells ranging in depth from 10 to 60 ft. Some enrichment of groundwater with sodium provided a possible key to differentiating septic-tank effluent from other urban groundwater contaminant sources. High ammonia nitrogen, phosphorus, and the repetitive detection of fecal coliform bacteria were characteristic of two 10-foot monitor wells that consistently indicated the presence of septic-tank effluent in groundwater. Fecal coliform bac-

teria were present on one or two occasions in many wells but the highest concentration, 1,600 colonies/100 ml, was related to storm-water infiltration rather than septic-tank discharge. The groundwater in the more permeable limestone in south Dade County near Homestead contained low concentrations of septic-tank related constituents. In north Dade County, where the aquifer is less permeable, groundwater contained the highest dissolved iron, manganese, COD, and organic carbon. (Woodard-USGS)
W76-06442

HYDROLOGIC DATA FOR THE IDAHO NATIONAL ENGINEERING LABORATORY SITE, IDAHO, 1971 TO 1973.
Geological Survey, Idaho Falls, Idaho.
J. T. Barraclough, and R. G. Jensen.
Available from National Technical Information Service Springfield, Va, 22161 as IDO-22055 \$5.50 printed copy; \$2.25 microfiche. Open-file report 75-318, January 1976. 52 p, 37 fig, 3 tab, 15 ref.

Descriptors: *Water pollution sources, *Groundwater, *Radioactive wastes, *Injection wells, *Colorado, Chemical wastes, Data collections, Aquifers, Water levels, Groundwater recharge, Path of pollutants, Infiltration, Hydrogeology, Observation wells, Radioactive waste disposal.
Identifiers: *Idaho National Engineering Laboratory, *Waste ponds.

The influence of liquid radioactive and chemical waste disposal is described for the Snake River Plain aquifer at the Idaho National Engineering Laboratory (INEL). In 1971 to 1973, an average of 237 water samples were collected annually, and an average of 600 chemical and radiometric determinations was made annually. An annual average of 817 water-level measurements was made in wells to determine the relations of water-level fluctuations to the movement of wastes. The 25 INEL production wells pumped an annual total of 2.5 billion gallons of water during 1971 to 1973. About 50% of this pumpage was returned to the aquifer. The Test Reactor Area utilizes ponds and a deep well to dispose of about 400 million gallons of dilute wastes per year. About half of the liquid waste is discharged to a radioactive waste pond. Infiltration from the ponds has formed a large perched-water body in the basal. The perched groundwater body contains tritium, chromium-51, cobalt-60, and strontium-90. The extent and concentration of these radionuclides are shown on maps. A chemical processing plant discharges low-level radioactive waste and chemical waste directly to the Snake River Plain aquifer through a 600-foot disposal well. The distribution of waste products in the Snake River Plain aquifer covers about 15 square miles. Since disposal began in 1952, the wastes have migrated about 5 miles downgradient from discharge points. (Woodard-USGS)
W76-06447

SUBMERGED MULTIPOINT DIFFUSERS FOR COOLING WATER DISCHARGE.
Massachusetts Inst. of Tech., Cambridge, Mass. (Assignee).
For primary bibliographic entry see Field 5D.
W76-06464

OREGON SYNTHETIC CLEANSING AGENT ACT.
For primary bibliographic entry see Field 6E.
W76-06502

INORGANIC CHEMICALS MANUFACTURING POINT SOURCE CATEGORY.
Environmental Protection Agency, Washington, D. C.
For primary bibliographic entry see Field 5G.
W76-06514

THE EFFECT OF LAND USE ON THE CHEMICAL AND PHYSICAL QUALITY OF SURFACE AND GROUND WATERS IN SMALL WATER SHEDS.
Massachusetts Univ., Amherst. Dept. of Plant and Soil Sciences.
M. E. Weeks.

Available from the National Technical Information Service, Springfield, Va., as PB-251 890, \$3.50 in paper copy, \$2.25 in microfiche. Massachusetts Water Resources Center, Amherst, Publication 41, Completion Report 74-7, September 1974. 9 p, 2 tab, 4 ref. OWRT A-040-MASS(1)

Descriptors: *Land use, *Massachusetts, Small watersheds, *Water pollution sources, *Nitrates, *Phosphates, Farm wastes, Domestic wastes, Fertilizers, Water quality, Surface waters, Groundwater, Organic matter.
Identifiers: *South River watershed(Mass).

Results obtained from monitoring surface and ground waters gave only a qualified answer to the question of how to obtain some initial estimate of the effects of different land use patterns on water quality in the small watershed used (South River watershed - part of the Deerfield River and Connecticut River systems). This river is about 15 miles in length and has five named tributary brooks and numerous lesser part-time streams draining the watershed of approximately 16,400 acres. Agricultural wastes come largely from manure produced by the nearly 1100 head of cattle on the farms in the area, and from crop residues, and, to a lesser extent, from fertilizers used. The houses of residence, including those in Ashfield and Conway centers, contribute most of the effluents from septic tanks and considerable raw sewage directly to the South River. Eight stations were located at different places along the stream; water samples from the river at each of these stations were taken on a monthly basis for analysis. Low ground water phosphate concentrations were always found in lysimeters located in an area of the watershed where different soil management practices could be studied. No evidence of leaching was found from three field sites receiving moderate to sometimes heavy applications of manure and fertilizers. Laboratory and field studies with suction lysimeters on nitrate concentrations in water conclusively show that in many soil situations most of the nitrate-nitrogen not utilized by the crop is lost by denitrification rather than by leaching. The presence of high levels of active organic matter supplied in high application rates of manure are conducive to rapid denitrification.
W76-06552

SUMMARY AND CONCLUSIONS: NUTRIENT TRANSPORT AND ACCOUNTABILITY IN THE LOWER SUSQUEHANNA RIVER BASIN.
Environmental Protection Agency, Annapolis, Md. Annapolis Field Office.
L. J. Clark, V. Guide, and T. H. Pfeiffer.
Available from the National Technical Information Service, Springfield, Va. 22161 as PB-240 151, \$5.00 in paper copy, \$2.25 in microfiche. Technical Report 60, October 1974. 94 p, 45 tab, append.

Descriptors: Water quality control, *Eutrophication, Industrial wastes, *Nitrates, Sewage treatment, Water pollution sources, *Nutrient removal, Nitrogen compounds, *Phosphorous compounds, *Water assimilative capacity, *Chesapeake Bay, Water pollution effects, Water pollution treatment, Pennsylvania, Maryland.
Identifiers: Non-point sources, Point source control, *Susquehanna River Basin, Nutrient loading, Northumberland(PA), Conowingo(MD).

Progressive eutrophication of the Chesapeake Bay resulting from discharge of nitrogen and phosphorus in the Susquehanna River between Northumberland, PA, and Conowingo, MD, prompted the EPA to initiate a comprehensive study of the river and to develop a nutrient

management program. Comprised of monitoring and sampling of stream stations and sewage treatment plants, the study developed the following objectives: identification of nitrogen and phosphorous loadings; determination of seasonal variations in loadings; delineation of point and non-point sources; determination of loading rates from agricultural, forestry and urban areas; seasonal mass balance of loadings; and determination of phosphorous 'sinks' resulting from impoundments. Results are presented of data analysis and interpretation utilizing regression analysis to establish relationship between both nutrient concentration and loading versus stream flow. Even with point source phosphorous control, impacts from expected population growth will require consideration of non-point source control as well as high degree of phosphorous and nitrogen removal at point sources. Hopefully, management agencies will utilize these data and expand upon them to develop land use management programs in conjunction with point source control of nutrients. Future studies recommended included fertilizer application studies, significance of construction industry as a non-point source, and determination of non-point sources in urban runoff. (Salzman-North Carolina)
W76-06575

EFFECT OF SALINIZATION ON CERTAIN SOIL MICROFLORA.
Institute for Applied Research on Natural Resources, Baghdad (Iraq).
For primary bibliographic entry see Field 5C.
W76-06582

SURFACE RUNOFF AND ITS EFFECT ON DIFFUSE SALT PRODUCTION FROM MANCOS SHALE MEMBERS.
Utah State University, Logan, Dept. of Civil and Environmental Engineering.
For primary bibliographic entry see Field 2G.
W76-06583

FINITE STATE MIXING-CELL MODELS.
Arizona Univ., Tucson. Dept. of Hydrology and Water Resources.
For primary bibliographic entry see Field 2F.
W76-06594

WATER QUALITY MODEL FOR SMALL AGRICULTURAL WATERSHEDS.
West Virginia Univ., Morgantown.
M. H. Meghji.
Available from the National Technical Information Service, Springfield, Va 22161, as PB-251 940, \$6.00 in paper copy, \$2.25 in microfiche. PhD thesis, 1975. 142 p. 25 fig., 16 tab., 109 ref., 3 append.
OWRT A-012-WVA (1).

Descriptors: *Agricultural watersheds, *Agricultural runoff, *Pollutants, *Mathematical models, *Erosion, Farm wastes, Sediments, Nitrogen, Phosphorus, Organic matter, Specific conductivity, Inorganic compounds, Hydrogen ion concentration, Salts, Bacteria, Calcium, Fertilizers, Magnesium, Sodium, West Virginia, Potassium, Model studies.

A literature review discloses contradictory conclusions as to the extent agricultural runoff contributes to water and air pollution. To investigate the actual and potential importance of agricultural runoff, a study is described which was conducted at the West Virginia University-Morgantown as a basis for a mathematical model to characterize the surface runoff and tile drainage from a small agricultural watershed, including the interrelationships between soil types, hydrologic, climatologic, and pollution indices. Measurements included rainfall, runoff, sediment, organic matter, nutrients, and bacterial densities carried to the stream from surface and subsurface runoff. The predictive model, based on the Universal Soil

Loss Equation and regression analysis, held well for the data collected, except for the winter months. The model has a much wider use because it takes into consideration most of the factors thus far identified as affecting the quality of agricultural runoff. Although the constant 'K' in the model related the total-nitrogen, total phosphorus, and COD to sediment, and is specific to this watershed, it can be estimated from soil fertility data and enrichment ratios for other watersheds. It is concluded that erosion rather than fertilizer is a major contributor of pollutants to surface waters although indiscriminate fertilizer use will also be a contributing factor. (Auen-Wisconsin).
W76-06641

CHEMICAL/BIOLOGICAL RELATIONSHIPS RELEVANT TO ECOLOGICAL EFFECTS OF ACID RAINFALL.
National Ecological Research Lab., Corvallis, Oreg.
For primary bibliographic entry see Field 5A.
W76-06650

USE OF SILVER AND ZINC TO TRACE SEWAGE SLUDGE DISPERSAL IN COASTAL WATERS.
Delaware Univ., Newark. Coll. of Marine Studies.
F. Rutherford, and M. Church.
Reprint No. 27 from ACS Symposium Series, No. 18, DEL-SG-3-76, 1975. p 440-452, 4 fig., 2 tab., 11 ref. Sea Grant No. 04-3-158-30.

Descriptors: *Sewage, *Sewage sludge, *Sludge disposal, *Tracers, *Zinc, Sludge, *Dispersion, Movement, Tracking techniques, Coasts, *Path of pollutants, Bays, Pennsylvania, New Jersey, Metals, Bioindicators.
Identifiers: *Sewage sludge dispersal, Coastal waters, *Silver, *Delaware Bay.

Sewage sludge from the municipal plants of Philadelphia, Pennsylvania, and Camden, New Jersey, has been dumped some 12 miles off the mouth of the Delaware Bay from 1961 to 1972 in amounts averaging 389,340 m³/year. Since 1973 the disposal area has been moved some 40 miles off-shore. Assays of silver and zinc in bottom sediments surrounding the Philadelphia dump site were employed to disclose the possible dispersion of sewage sludge. These trace metals are highly concentrated in the secondary treated sewage sludge from the Philadelphia metropolitan area, and display sensitive indications as tracers for the bottom dispersal of the sludge off the mouth of Delaware Bay. From such metal distributions, it is fair to conclude that the sludge has moved out of the former designated area of disposal some tens of miles shoreward, toward the west. A possible link between the sludge and a food web is implicated. (NOAA)
W76-06655

SEWAGE SLUDGE AND AMMONIUM CONCENTRATIONS IN THE NEW YORK BIGHT APEX.
State Univ. of New York at Stony Brook. Marine Sciences Research Center.
I. W. Duedall, M. J. Bowman, and H. B. O'Connors Jr.
Estuarine and Coastal Marine Science Vol. 3, p 457-463, 1975, 3 fig., 1 tab., 11 ref. Grants 2-35281 and 5505SR0767-08

Descriptors: *Sewage sludge, *Sludge, *Sewage disposal, *Sludge disposal, *Waste disposal, *Ammonium compounds, Sampling, Water pollution, Water treatment, Phytoplankton, Waste dumps, New York.
Identifiers: *Ammonium concentrations, *New York Bight Apex, Dump sites, Parachute drogues, Water columns, Water bottom concentrations, Marine life.

Water column ammonium concentrations were determined at several stations at or near the sewage sludge dump site in the New York Bight apex on 30 and 31 July, 1973 and also at several stations located on a perimeter surrounding the dump area. Parachute drogues were used to track the movement of water over a 31-hour period. Within the dump site, ammonium concentrations were micro matchy and usually increased from surface to bottom with concentrations in the ranges of less than 1UM and 1-9 micro m, respectively. However, at one station that had recently received sludge input, the surface ammonium concentration was over 500 micro m and the bottom concentration was about 200 micro m. All except two background stations showed no significant vertical variation in ammonium. The observations suggest that sludge dumping increases ammonium content of the water column, but that high levels probably do not persist for long periods. (NOAA)
W76-06667

FIELD STUDIES OF THE THERMAL PLUME FROM THE D. C. COOK SUBMERGED DISCHARGE WITH COMPARISONS TO HYDRAULIC-MODEL RESULTS.
Argonne National Lab. III. Energy and Environmental Systems Div.
A. A. Frigo, R. A. Paddock, and D. L. McCown.
Publication ANL/WR-75-4, June 1975. 35 p., 33 fig., 4 tab., 9 ref. ERDA W-31-109-Eng38

Descriptors: *Thermal pollution, *Hydrothermal studies, *Nuclear powerplants, *Lake Michigan, Path of pollutants, Testing, Hydraulic models, Diffusion, Discharge(Water), Cooling water, Measurement, On-site data collections, Prototypes, Isotherms, Heat transfer, Water temperature.
Identifiers: Submerged-diffuser discharges, *Waste heat, *Thermal plume, D.C. Cook plant(Mich), Prototype data, Model predictions.

The Donald C. Cook Nuclear Plant at Bridgman, Michigan, uses submerged-diffuser discharges as a means of disposing waste heat into Lake Michigan. This report presented preliminary results of temperature surveys of the thermal plume at the D. C. Cook Plant. Indications are that the spatial extent of the plume at the surface is much smaller than previous results for surface shoreline discharges, particularly in the near and intermediate portions of the plume. Comparisons of limited prototype data with hydraulic (tank)-model predictions indicated that the model predictions for centerline temperature decay at the surface are too high for the initial 200 m from the discharge, but are generally correct beyond this point to the limits of the model. In addition, the hydraulic-model results underestimate the areal extent of the near and intermediate portions of the plume at the surface. Because this is the first report of a new field program, several inadequacies in the field-measurement techniques were noted and discussed. New techniques that have been developed to remedy these deficiencies, and which will be implemented for future field work, were also described. (Morris - ISWS)
W76-06673

THE RATE OF SPREAD OF FUEL OIL NO. 1.
Geological Survey of Sweden, Stockholm.
B. Sellberg.
Nordic Hydrology, Vol. 6, No. 1, p 63-72, 1975. 8 fig., 3 ref.

Descriptors: *Water pollution, *Groundwater, *Oil spills, Oil pollution, Groundwater movement, Sands, Soils, Oil, Soil contamination, On-site investigations, Analytical techniques, Pollutants, Pollutant identification, Path of pollutants.
Identifiers: *Oil movement in soils.

Experiments have been made in the field to determine the way in which fuel oil No. 1 spreads in some common unconsolidated deposits in Sweden, such as esker material, bottom varves of

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glacial clay and sand on clay. In the investigations, the velocity of fuel No. 1 in reasonably homogeneous medium sand with a good groundwater flow was found to be 1.0-1.6 m/day, but usually the velocity was as low as 0.1-0.2 m/day. Experiments covering a longer period showed that the maximum concentration diminished very much in transport up to a distance of about 20 m. (Sims-IsWS)

W76-06677

MONITORING GROUND-WATER QUALITY NEAR A SANITARY LANDFILL,
Earthview, Incorporated, Toledo, Ohio.
For primary bibliographic entry see Field 5A.
W76-06684

STUDY OF THE DISPERSION OF BACTERIOPHAGES IN A NATURAL MARINE ENVIRONMENT, (IN FRENCH),
Centre d'Etudes et de Recherches de Biologie et d'Océanographie Médicale, Nice (France); and Institut National de la Recherche Médicale, Paris (France).
C. Pietri, J. P. Breittmayer, M. Aubert, and M. Gauthier.
Rev Int Oceanogr Med 39/40, p 95-108, 1975.

Descriptors: *Bacteriophages, *Dispersion, *Path of pollutants, Dye dispersion, Rhodamine, Sea water, Marine environment, Tracers.

The dispersion of P22 and T4 bacteriophages in the sea was compared with the diffusion of the dye Rhodamine B; no difference was found. There apparently is neither adsorption of these bacteriophages on particles in aqueous systems, nor activation by seawater in terms of time.—Copyright 1975, Biological Abstracts, Inc.
W76-06691

TELEDETECTION BY AIRPLANE AND SATELLITE IN THE STUDY OF MARINE POLLUTION, (IN FRENCH),
Centre d'Etudes et de Recherches de Biologie et d'Océanographie Médicale, Nice (France).
For primary bibliographic entry see Field 5A.
W76-06717

PHOSPHORUS SOURCES FOR THE LOWER MADISON LAKES,
Wisconsin Univ., Madison. Water Chemistry Lab.
W. Sonzogni, and G. F. Lee.
Wisconsin Academy of Sciences, Arts and Letters, Vol. 63, p. 162-175, 1975. 1 fig., 12 tab., 19 ref.
EPA 16010EHR.

Descriptors: *Phosphorus, *Lakes, Wisconsin, Agricultural runoff, Urban runoff, Land use, Precipitation (Atmospheric), Fallout.
Identifiers: *Madison (Wis), *Phosphorus sources, Lake Monona (Wis), Lake Mendota (Wis), Lake Waubesa (Wis), Lake Kegonsa (Wis), Yahara River (Wis).

The soluble orthophosphate and total phosphorus loading to and outflow from the lower of the chain of lakes (Monona, Waubesa, and Kegonsa) in Madison, Wisconsin are estimated to determine the effect of diversion of sewage effluents. The largest phosphorus source to these lakes is the Yahara River; i.e., for each of the lower lakes the outflow from the higher lake in the chain is the principal source. In contrast, the headwater Lake Mendota, with a much larger drainage basin, receives most of its phosphorus input from rural runoff. Rural runoff is the second most important phosphorus source to Lakes Waubesa and Kegonsa, but loading estimates are much lower than the pre-diversion estimates. Despite the reduction in the phosphorus loading, these lakes are still highly eutrophic. Urbanization within the Lake Mendota watershed is projected to double by 1900, nevertheless the increase in phosphorus loading

would be small compared to the total load dominated by the Yahara River. The effect of urbanization would be significant, however, if new urban areas were at one time marshes. It is estimated that southeastern Wisconsin marshes could yield on the order of 45 kg of phosphorus/ha upon drainage. (Auen-Wisconsin)

W76-06718

DEGREE OF POLLUTION OF THE SAINT LAWRENCE RIVER FROM REPENTIGNY TO MONTMAGNY, (IN FRENCH),
Laval Univ., Quebec. Département des Vivres.
J. G. Noel, and R. E. Simard.
Nat Can (Que) 102(2), p 199-208, 1975.

Descriptors: *St. Lawrence River, *Canada, *Bacteria, Microbiology, Coliforms, Streptococcus, Water quality standards, *Path of pollutants, Bioindicators, Wastes, Molds, Yeasts.
Identifiers: Montmagny, Ontario, Quebec, Repentigny.

The microbial water pollution level of the St. Lawrence River between Repentigny and Montmagny (Quebec, Canada) was studied from June-Sept. 1971. This area was divided into 31 sampling stations and averages of 450,000 total bacteria, 1100 total coliforms, 200 fecal coliforms, 45 fecal streptococci and 1300 yeasts and molds were found per 100 ml of water. These groups of microorganisms are the principal indicators of microbial contamination of water from domestic, human, animal, agricultural and industrial wastes. The results obtained from this microbiological survey, compared to those obtained from the Great Lakes and from the International Section of the St. Lawrence River and to the water quality criteria and Canada and Ontario, showed that a high level of microbial contamination occurs in the St. Lawrence River. The highest polluted stations were those of Sorel, Trois-Rivières, Quebec and the north channel of the River at the Orleans Island. (See also W76-06735)—Copyright 1975, Biological Abstracts, Inc.
W76-06734

DEGREE OF POLLUTION OF THE SAINT LAWRENCE RIVER FROM REPENTIGNY TO MONTMAGNY: II. BIOCHEMICAL POLLUTION, (IN FRENCH),
Laval Univ., Quebec. Département Des Vivres.
J. G. Noel, and R. E. Simard.
Nat Can (Que) 102(2), p 209-218, 1975.

Descriptors: *St. Lawrence River, *Canada, *Biochemistry, *Path of pollutants, Nitrates, Nitrogen, Chemical oxygen demand, Wastes, Bioindicator, Phosphates.
Identifiers: Ammonia nitrogen, Quebec, Repentigny, Montmagny.

The biochemical water pollution level of the St. Lawrence River studied from Repentigny to Montmagny (Quebec, Canada) during June-Sept. 1971. This area covered was divided into 31 sampling sections and the mean results in mg/liter were 0.522 organic nitrogen (Keljdahl-nitrogen), 0.280 ammonia nitrogen, 0.515 nitrate, 0.061 orthophosphate, 21.3 chemical O₂ demand. These compounds are the principal indicators of biochemical water pollution from domestic, agricultural, animal and industrial wastes. The results obtained which were compared to those from the Great Lakes, the International Section of the St. Lawrence River and to the water quality criteria in Canada and Ontario show that a high level of pollution occurs in the St. Lawrence River, particularly near Repentigny, Tracy, Trois-Rivières, Donnacona, Quebec and the North and South Branch of the River at the Orleans Island. (See also W76-06734)—Copyright 1975, Biological Abstracts, Inc.
W76-06735

THE WINTER DISTRIBUTION OF ULTRAVIOLET ABSORPTION IN THE SURFACE WATERS OFF THE WEST COAST OF THE BRITISH ISLES,
University Coll. of North Wales, Menai Bridge. Marine Science Labs.
P. Foster, and A. W. Morris.
Environ Pollut. 7(2), p 121-132, 1974.

Descriptors: *Salinity, Coasts, Oceans, *Ultraviolet radiation, Measurement, *Path of pollutants, *Organic matter, Estuaries, *Distribution, Water pollution, Absorption, Surface water.

Concurrent measurements of salinity and the integrated UV absorption in the wavelength range 250-350 nm were made in the surface waters of Beaumaris, Cardigan and Liverpool Bays during the winter. Organic matter derived from land drainage rather than that produced by in situ biological activity controlled the magnitude of the absorption. The high absorptions recorded in Liverpool Bay were principally attributed to greater fluvial discharge rather than to absorption enhancement from polluted sources. It was not possible to distinguish spectrally any contribution to the dissolved organic matter from industrial or domestic sources. The increase in absorption caused by a decrease of 1‰ in salinity was greater in Liverpool Bay than in Cardigan Bay, principally as a result of the relatively high concentrations of dissolved UV absorbing organic matter in waters adjacent to the river Mersey estuary.—Copyright 1975, Biological Abstracts, Inc.
W76-06739

SEASONAL DISTRIBUTION OF ULTRAVIOLET ABSORPTION IN THE SURFACE WATERS OF LIVERPOOL BAY,
University Coll. of North Wales, Menai Bridge. Marine Science Labs.
P. Foster, and A. W. Morris.
Estuarine Coastal Mar Sci. 2(3), p 283-290, 1974.

Descriptors: Seasonal, *Distribution, *Salinity, Surface water, *Organic matter, *Ultraviolet radiation, Estuaries, *Path of pollutants, Bays, Water pollution, Absorption, Rivers.
Identifiers: Liverpool Bay (England).

Concurrent measurements of salinity and the integrated UV absorption in the wavelength range 250-350 nm were made in the surface waters of Liverpool Bay (England) during 4 cruises conducted in Sept. and Dec. 1970 and March and July 1971. Except during Sept. the distribution and magnitude of the UV absorption were predominantly influenced by organic matter introduced from land sources rather than by in situ biological activity. Highest values of ultraviolet absorption consistently occurred adjacent to the estuary of the River Mersey and River Ribble. Waters from the River Mersey were organically 'dirty' relative to all other freshwater sources in the area.—Copyright 1975, Biological Abstracts, Inc.
W76-06740

NITRATES IN KANSAS GROUNDWATERS AS RELATED TO ANIMAL AND HUMAN HEALTH,
Kansas State Univ., Manhattan. Comparative Toxicology Lab.
W. E. Ridder, F. W. Oehme, and D. C. Kelley.
Toxicology. 2(4), p 397-405, 1974.

Descriptors: Nitrates, Kansas, Animal diseases, Human diseases, Water wells, Groundwater, Water pollution sources, Potable water, Public health, Fertilizers.

Sources of nitrates observed in farm well water appear related to improper location and construction of wells. Statistical analysis of the low levels of applied inorganic N fertilizer suggest that the fertilizer applied was not related to the nitrate con-

tent of the water. Although the presence of animal health problems did not correlate with levels of nitrates in well waters and with the use of inorganic fertilizers, the presence of many variables made evaluation difficult. The nitrate levels in many rural and domestic water supplies were sufficiently high to potentially produce physiological impairment in animals drinking those waters. Clinical signs may have been obscured by their own complexity and subtlety. The significance of nitrates in drinking water can currently be objectively measured only by the development of acute nitrate poisoning. —Copyright 1975, Biological Abstracts, Inc.
W76-06754

SEQUENCES OF EFFECTS OF A CITY SEWER: AS A FUNCTION OF THE REMOVAL OF THE SOURCE OF POLLUTION, ON THE PHOTO-PHILE POPULATIONS GROWING IN EXPOSED PLACES (ALGAL FRACTION); FIRST RESULTS, (IN FRENCH), Aix-Marseille-2 Univ. (France). Laboratoire de Biologie Végétale.
For primary bibliographic entry see Field 5C.
W76-06770

THE HEAVY METAL CONCENTRATIONS IN THE MARINE SEDIMENTS ALONG THE COAST OF FUKUYAMA, (IN JAPANESE), Kagoshima Univ. (Japan). Marine Biology Lab.; and Kagoshima Univ. (Japan). Environmental Sciences.
For primary bibliographic entry see Field 5A.
W76-06774

SUSPENDED MATTER AND ITS COMPONENTS IN THE BLACK SEA, (IN RUSSIAN), Institute of Biology of the Southern Seas, Sevastopol (USSR).
D. M. Vityuk.
Gidrobiol Zh 11(1), 12-18, 1975.

Descriptors: Bacteria, Assay, Suspended solids, Plankton, Metals, Sulfides, Sea water.
Identifiers: *Black Sea, USSR.

Assays of suspended matter (40) from the Black Sea near the Danube mouth, at the Bosphorus and in the central part of the Sea were examined in Nov. 1971. The data are compared with previously performed analyses from the Sevastopol area and the mouths of 19 rivers flowing into the Black and Azov Seas (USSR). The two main types of Black Sea suspension are of autochthonous and allochthonous origin. The formation of insoluble metal sulfides in deep water, specific for the Black Sea, is 1 of the sources of autochthonous suspended material. The carbonate portion of the mineral part of the Danube suspended material does not usually exceed 7%, in the mineral part of the abyssal region it is above 25%. —Copyright 1975, Biological Abstracts, Inc.
W76-06778

5C. Effects Of Pollution

NITROGEN, PHOSPHORUS AND CARBON FLUX IN CHESAPEAKE BAY MARSHES, Virginia Inst. of Marine Science, Gloucester Point. D. M. Axelrad, K. A. Moore, and M. E. Bender. Available from the National Technical Information Service, Springfield, Va. 22161, as PB-251 549, \$5.00 in paper copy, \$2.25 in microfiche. Virginia Water Resources Research Center, Blacksburg, VWRRC Bulletin 79, January 1976. 182 p. 53 fig., 17 tab., 106 ref., 2 append. OWRB B-027-VA (2).

Descriptors: *Nitrogen, Estuaries, *Phosphorus, *Nitrogen fixation, Marshes, *Carbon, Detritus, *Chesapeake Bay, Algae, *Virginia, *Salt marshes, Wetlands, Nitrates, Nitrites, Dissolved

solids, *Nitrogen cycle, *Cycling nutrients, Path of pollutants.
Identifiers: Spartina, Dissolved carbon, Benthic algae, Organic carbon.

Annual nitrogen, phosphorus and carbon budgets for two Virginia salt marshes were determined by monthly measurements of water discharge and constituent concentrations over tidal cycles. Considering all three forms of phosphorus measured (total, dissolved organic and orthophosphate) there was a net loss from the estuary to the marshes. The data reveal a loss of particulate phosphorus of estuarine origin to marsh sediments and mineralization of this phosphorus in the marshes with subsequent export of dissolved inorganic and organic phosphorus back to the estuary. Nitrogen flux data show a loss of nitrate and nitrite to the marshes. Particulate nitrogen is imported to the marshes where it is mineralized and returned to the estuary as ammonia and dissolved organic nitrogen. The magnitude of nitrogen export suggests significant fixation of atmospheric nitrogen by marsh flora with subsequent export as dissolved species. Carbon flux data show significant contributions of both particulate and dissolved organic carbon to the estuary from the marshes. Estimates of export, based on marsh grass productivity, suggest a loss of 36 and 49 percent of a year's primary production on the marshes as detritus for Ware and Carter Creeks respectively.
W76-06162

THE WATER FAUNA OF THE HIGH MOUNTAIN GLACIER LAKES IN THE MANDARAS VALLEY IN THE HIGH HINDU KUSH, (IN POLISH), Jagellonian Univ., Krakow (Poland). Instytut Zoologii Systematic; and Jagellonian Univ., Krakow (Poland). Instytut Zoogeography. J. Wojtusik, K. Sowa, and A. Kownacki. Przegl Zool 19(1), p 66-70, 1975.

Descriptors: *Aquatic animals, *Lakes, Diptera, Algae, Chironomidae, Water pollution effects.
Identifiers: *Afghanistan (High Hindu Kush), Allocapniella-Pedestris, Capnia-SPP, *Glacier lakes, Hindu, Kush, Mandaras, Microspectra, Oedogoniales, Pseudodiamesa-Sp.

The water fauna of 2 glacier lakes at an elevation of about 5000 m in the Mandaras valley in the High Hindu Kush (Afghanistan) are described. Two species Capnia Pict., Allocapniella pedestris (Kimmings) sensu Kawai (Plecoptera, Capniidae), Pseudodiamesa sp., Microspectra sp. (Diptera, Chironomidae) and some algae belonging to the Oedogoniales are reported. —Copyright 1975, Biological Abstracts, Inc.
W76-06166

ENERGY AND POLLUTION CONCERNS IN DREDGING, Army Engineer Div. South Atlantic, Atlanta, Ga. A. W. Mohr.
Journal of the Waterways, Harbors and Coastal Engineering Division, American Society of Civil Engineers, Vol. 101, No. WW4, Proceedings Paper 11733, p 405-417, November 1975. 4 fig., 1 tab., 3 ref., 2 append.

Descriptors: *Dredging, *Canals, Channels, Construction equipment, *Energy, Air pollution, Excavation, Earth handling equipment, Sediments, Environmental engineering, Slurries, Land reclamation, Solid wastes, Water pollution.
Identifiers: *Dredges, *Waterways, Excavating equipment.

Dredging equipment in the United States should be augmented for a more versatile dredging fleet by the addition of the mechanical bucket ladder dredge for channel work. The addition of the bucket ladder dredge is especially desired in view of the relatively new concerns of energy conservation and pollution abatement. From these con-

cerns, the former is well defined but the latter is not. In most cases both concerns oppose each other and interfere with the conventional concept of economy. The new concerns are expected to shift the conventional concept of economy toward efficiency in terms of amount of bottom density material dredged, transported, and deposited per unit of fuel. This shift is expected to be accompanied by a change in emphasis from maximum solid flow rate toward maximum effluent density. Bucket ladder dredges are inherently well suited to satisfy the new concerns, especially at long transport distances. (Roberts - ISWS)
W76-06183

ACETYLENE REDUCTION ASSAYS FOR NITROGEN FIXATION IN FRESHWATERS: A NOTE OF CAUTION, Manitoba Univ., Winnipeg. Dept. of Microbiology. For primary bibliographic entry see Field 5A.
W76-06202

THE BIOGEOCHEMISTRY OF PHOSPHORUS IN AN EXPERIMENTAL LAKE ENVIRONMENT: EVIDENCE FOR THE FORMATION OF HUMIC-METAL-PHOSPHATE COMPLEXES, Fisheries Research Board of Canada, Winnipeg (Manitoba). Freshwater Inst.
T. A. Jackson, and D. W. Schindler. Verhandlungen Internationale Vereinigung Limnologie, Vol. 19, p. 211-221, 1975. 11 fig., 1 tab., 14 ref.

Descriptors: *Cycling nutrients, *Chelation, *Phosphorus, *Humus, Chemical reactions, Bottom sediments, Microorganisms, *Canada, Iron, Aluminum, Carbon, Fulvic acids, Humic acids, Lakes.
Identifiers: *Phosphorylation.

Movements, transformations, and interactions with humic matter of P32 labeled orthophosphate were studied in outdoor pools containing lake water, lake water + bottom mud, or lake water + bottom mud + formalin. Microorganisms changed dissolved P32 phosphate into higher molecular weight substances and accelerated transfer of dissolved P32 to mud. Water and mud were fractionated and subjected to gel filtration, then analyzed. Most lake water P32 was water-extractable. Most P32 in mud was non-extractable and the extractable portion was concentrated in the sodium hydroxide extract. Phosphorus was always associated with iron and aluminum, not calcium. P32 was highest in fractions richest in humic matter. In Sephadex fractions of alkali-extracted humic matter from mud, iron, aluminum, and phosphorus were correlated with organic carbon. There was a relationship between P32 bound per micromole iron + aluminum and the molecular structure of humic matter and an inverse relationship between P32 and total phosphorus per micromole iron + aluminum. It is concluded that phosphorus was bound to iron and aluminum complexes of humic matter. Added P32 coordinated only to iron and aluminum atoms not already saturated with phosphorus. More P32 was bound per mole iron + aluminum in fulvic acid than in humic acid fractions. (Buchanan-Davidson—Wisconsin)
W76-06203

THE PHYTOPLANKTON AND PRIMARY PRODUCTIVITY OF SOUTHERN INDIAN LAKE (MANITOBA), A HIGH LATITUDE, RIVERINE LAKE, Fisheries Research Board of Canada, Winnipeg (Manitoba). Freshwater Inst.
R. E. Hecky. Verhandlungen Internationale Vereinigung Limnologie, Vol. 19, p. 509-605, 1975. 3 fig., 2 tab., 6 ref.

Descriptors: *Phytoplankton, *Primary productivity, *Canada, Lakes, Rivers, Phosphorus, Biomass, Chlorophyll, Nutrients, Light penetra-

Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

Group 5C—Effects Of Pollution

tion, Discharge(Water), Inflow, Dominant organisms, Water circulation.
Identifiers: *Riverine lakes, *Southern Indian Lake, Manitoba, *Churchill River(Manitoba), River plumes, Melosira, Nutrient sources.

Southern Indian Lake, Manitoba, was studied to determine mechanisms causing high production in this riverine lake and to assess the river's role in maintaining productivity. Although mean water residence time was 9 months in the entire lake, the Churchill River plume was renewed every two-three months and was the source of a relatively high phosphorus load. Lake mainstem stations had higher average algal biomass and chlorophyll concentrations than regions receiving local drainage; these correlated with estimated phosphorus loadings, but algal biomass and chlorophyll ranges were less than expected from nutrient considerations. Biomass and Secchi disk depths increased from inlet to outlet. Increasing clarity away from the inlet was due to sedimentation. In the mainstem, *Melosira* dominated during phytoplankton maxima. Nutrients declined rapidly with onset of spring bloom. The two phytoplankton maxima occurred earlier near the inlet than the outlet; this was not due to differential heating but was flow related, suggesting that nutrient recharge from the river after the spring bloom was required to initiate the second maximum. Productivity experiments indicated that in late summer upstream lake regions were in a period of population replacement or decline, while the lower lake had actively growing populations and higher production rates. (Buchanan-Davidson-Wisconsin)
W76-06204

ALGAE FROM MONTANE STREAMS ON THE ISLAND OF MAHE, IN THE SEYCHELLES.
Polish Academy of Sciences, Krakow. Instytut Botaniki.
K. Starmach.
Acta Hydrobiologica, Vol. 17, No. 3, p. 201-209, 1975. 4 fig., 8 ref.

Descriptors: *Systematics, *Algae, *Streams, Islands, Cyanophyta, Chlorophyta, Rhodophyta, Diatoms, Periphyton, Varieties, Africa, *Indian Ocean.
Identifiers: Mahe Island, *Seychelles Islands.

Samples of algae were collected in mountain streams on the Island of Mahe in the Seychelles Island group located in the west Indian Ocean north of Madagascar. Six species of blue-green algae (*Homocothrix juliana*, *Calothrix muscicola* nova sp. ad interim, *Scytonema bohneri*, *Lyngbya kutzingii*, *L. aerugineo-coerulea*, and *L. amplivaginata*), one species of green algae (*Oedogonium* sp. *Penium* polymorphum), and one species of red algae (*Batrachospermum capensis* spec. nova) were identified. Detailed descriptions are presented for all algae found. The blue-green alga, *Calothrix muscicola*, is probably a new species, differing in size and in the absence of swelling at the base from *C. epiphytica* or *C. stellaris*. Twenty species of diatoms were also identified and the frequency of their distribution recorded; *Achnanthes minutissima*, *Eunotia arcus* var. *fallax*, *Eunotia fallax*, *Frustulia saxonica* var. *leptocephala*, and *Gomphonema gracile* were the most common. (Buchanan-Davidson-Wisconsin)
W76-06205

ALGAE IN THE GEBEL MARRA MTS IN WEST SUDAN.
Polish Academy of Sciences, Krakow. Instytut Botaniki.
K. Starmach.
Acta Hydrobiologica, Vol. 17, No. 3, p. 211-221, 1975. 5 fig., 1 tab., 3 ref.

Descriptors: *Algae, *Chlorophyta, *Cyanophyta, *Diatoms, *Rhodophyta, *Africa, Speciation, Systematics, Nostoc, Cladophora, Variety, Subtropical, Foods, Diets.

Identifiers: *Gebel Marra (Sudan), Lake Dariba, *Spirulina platensis*, *Spirulina massartii*, *Dermocarpa xenococcoides*, *Nostochloa lobatus*, *Biddulphia levis*, *Fragilaria pinnata*, *Epithemia turrida*, *Rhopalodia gibberula* var. *van heurckii*, *Rhizoclonium*, *Spirogyra*, *Mougeotia*, *Oedogonium*, *Tribonema*, *Aoudouinea*.

Algae collected at five different sites in the volcanic Gebel Marra Mountains of West Sudan in 1964 were identified. A total of 31 different species of blue-green algae, 3 species of green algae, and 34 species of diatoms are described. Taxonomic studies were made of each algal species. The frequency of distribution of the various diatom species is indicated. The blue-green algae were the most common; the most characteristic of these were *Spirulina platensis* and *S. massartii*, which produced blooms in Lake Dariba. This species occurs in masses in subtropical countries and that of Lake Chad (Africa) is used as food by the natives, and is considered more digestible than *Chlorella*. Various species of *Nostoc* and *Dermocarpa xenococcoides* and *Nostochloa lobatus*, which are found only in tropical regions, were also present. The most characteristic and frequently found species of diatoms were *Biddulphia levis*, *Fragilaria pinnata*, *Epithemia turrida*, and *Rhopalodia gibberula* var. *van heurckii*. Smaller numbers of other species were also found. In the green algae, filamentous forms such as *Rhizoclonium*, *Cladophora*, *Spirogyra*, *Mougeotia*, *Oedogonium*, and *Tribonema* were found. The red alga *Aoudouinea* was also present; the blue-green alga *Dermocarpa xenococcoides* was always present on the filaments of this alga. (Buchanan-Davidson-Wisconsin)
W76-06206

WATER CHEMISTRY AND FERTILITY OF TWENTY-THREE CONNECTICUT LAKES.
Connecticut Agricultural Experiment Station, New Haven.
W. A. Norvell, and C. R. Frink.

Descriptors: *Water chemistry, *Lakes, *Eutrophication, *Connecticut, Turbidity, Color, Nitrogen, Phosphorus, Specific conductivity, Alkalinity, Calcium, Magnesium, Chlorophyll, Oxygen sag, Potassium, Chlorine, Lake morphology, Bicarbonates, Trophic level.

The water chemistry of twenty-three Connecticut lakes was studied in fall of 1973 and spring and summer of 1974 in order to evaluate the current condition of the lakes with respect to the plant nutrients, nitrogen and phosphorus; to determine which lakes have changed significantly during the last few decades; and to understand factors contributing to the eutrophication of these lakes. The lakes range from clear, infertile, oligotrophic water to turbid, highly fertile eutrophic water subject to excessive growth of algae and aquatic weeds. Many became eutrophic during the last few decades. Generally the concentrations of phosphorus and chlorophyll-a have increased and transparency decreased. During the summer, oxygen supplies in deep water are low. Algal populations, measured as chlorophyll-a were closely related to phosphorus concentrations. Phosphorus was in shorter supply than nitrogen in most lakes and is the nutrient most likely to limit algal growth. Eutrophication of these lakes undoubtedly associated with changes in type and intensity of land use in their watersheds. The appendix shows the sampling date and depth, the transparency, alkalinity, chlorophyll-a soluble phosphorus, total phosphorus, ammonia nitrogen, nitrate-nitrogen, soluble nitrogen and total nitrogen for each lake. (Buchanan-Davidson-Wisconsin)
W76-06207

NITROGEN AND SULFUR CONTENT AND PH OF PRECIPITATION IN IOWA.
Iowa State Univ., Ames. Dept. of Agronomy.
M. A. Tabataba, and J. M. Laffen.

Journal Environmental Quality, Vol. 5, No. 1, p. 108-112, 1976. 2 fig., 4 tab., 34 ref. 1845. 1A50010.

Descriptors: *Nitrogen, *Sulfur, *Hydrogen ion concentration, *Precipitation(Atmospheric), *Nutrients, Snow, Rain, Nitrates, Ammonia, Sulfates, Phosphates, Phosphorus, Annual, *Iowa.

To determine pH, ammonia nitrogen, nitrate nitrogen, sulfate sulfur, and phosphate phosphorus concentrations contained in precipitation in Iowa, and to determine what quantities of these nutrients are added annually by precipitation, six terrestrial sites were sampled between September 1971 and December 1973. Annual amounts of ammonia nitrogen and nitrate nitrogen added by precipitation were approximately equal. The annual amount inorganic nitrogen added per hectare ranged from 10 kg in north-central Iowa to 14 kg in west-central Iowa. Annual amount of sulfate sulfur added per hectare ranged from 13 kg in the northeast to 17 kg in the north-central. It was estimated that precipitation added an average of about 0.6 kg ammonia nitrogen, 0.6 kg nitrate nitrogen, and 1.5 kg sulfate sulfur per hectare monthly. Seasonal variations were observed for sulfate sulfur as values were higher in fall and winter than in spring and summer. The average annual pH was 6 in rainfall and snowfall both years; pH values were rarely as low as 4. The phosphorus content of precipitation was very small; at the most only about 0.1 kg of water soluble phosphate phosphorus was added annually per hectare. Nitrate nitrogen was not found in any precipitation sample analyzed. (Buchanan-Davidson-Wisconsin)
W76-06208

THE IMPORTANCE OF DIURNAL VARIATION OF PHOTOSYNTHESIS VS. LIGHT CURVES TO ESTIMATES OF INTEGRAL PRIMARY PRODUCTION.
Fisheries Research Board of Canada, Winnipeg (Manitoba). Freshwater Inst.
E. J. Fee.

Verhandlungen International Vereinigung Limnologie, Vol. 19, p. 39-46, 1975. 3 fig., 1 tab., 21 ref.

Descriptors: *Estimating, *Diurnal, *Photosynthesis, *Light intensity, *Primary productivity, Phytoplankton, Measurement, *Canada, Model studies, Time, Lakes, Annual.
Identifiers: Experimental Lakes Area(Ontario).

A method of estimating integral phytoplankton primary production based on photosynthetic response to light in an incubator, light extinction in the water body, and distribution of surface light over time using a digital computer program was modified incorporate variation of photosynthesis versus light curve during the day. Three lakes in the Experimental Lakes area, Ontario, were the study sites. There was no consistent change of photosynthetic rate over days at low irradiances, accounting for interaction between light and time. Results were summarized for computer analysis as follows: production at all irradiances was invariant from sunrise until noon, then declined linearly to minimum production at sunset. This model was incorporated into the computer program and used to compute annual lake basis productivity. A second model was developed assuming no diurnal variation at low irradiances. Another model used exponential rather than linear interpolation to compute production from incubator data. Samples should be taken in the morning to obtain comparable data. In calculating integral daily production, it is not important to incorporate diurnal variation effects, since sampling and data analysis errors are often greater. Simple simulation models can demonstrate the actual significance of seemingly important relationships like diurnal variation. (Buchanan-Davidson-Wisconsin)
W76-06210

ANNUAL DEVELOPMENT OF PLANKTON IN A RIVER WATER INTAKE WEIR AND IN A TREATMENT POND AND ITS REMOVAL IN TREATMENT PLANTS.
Instytut Kształtowania Środowiska, Warsaw (Poland). Zakład Użytkowania i Ochrony Wod. H. Klimowicz.
Acta Hydrobiologica, Vol. 17, No. 3, p. 299-308, 1975. 2 fig., 8 ref.

Descriptors: Resistance, *Plankton, *Water purification, *Water treatment, Water intakes, Varieties, Chlorination, Coagulation, Filtration, Settling basins, *Weirs.
Identifiers: *Uszwicka River (Poland).

Seasonal qualitative and quantitative phytoplankton changes in a river intake weir on the Uszwicka River, Poland, and a settling pond were investigated to determine their tolerance to several water purification stages. Diatoms numbers increased from intake to the middle of the pond, then decreased. Numbers of algae, protozoa, and rotifers increased throughout the pond length. Phytoplankton (especially diatoms) dominated all year, but zooplankton were rare. Species are classified by rates at which they were removed by water treatment (concrete settling tank with added coagulant, sand filtration, chlorination). Ninety-five taxonomic units were identified; forty-two were found in completely treated water, but specimen numbers were greatly reduced. Curves illustrating development of organisms in the pond and river intake were similar. Seasonal changes in plankton numbers seemed due to changes in mean water temperature. High dissolved oxygen and pH values of 7.1-7.6 were favorable to plankton growth. Fluctuations in water turbidity paralleled the total number of organisms. Turbid water was chiefly polluted with mineral rather than organic compounds. Rapid exchange of river water in the pond prevented plankton blooms. Plankton can be used to record changes occurring in treated water and evaluate treatment methods. (Buchanan-Davidson-Wisconsin).
W76-06211

CHANGES IN WATER QUALITY IN FINNISH LAKES AND RIVERS 1962-1973 (IN FINNISH WITH ENGLISH SUMMARY).
National Water Board of Finland, Helsinki. Research Inst.
R. Laaksonen.
Report No. 12, 1975. 66 p. 64 fig., 5 tab., 3 ref., 2 append.

Descriptors: *Water pollution, *Water quality, *Lakes, *Rivers, Specific conductivity, Chlorides, Sulfur, Regression analysis, Running waters, Autumn, Nitrogen, Alkalinity, Electrolytes, Acidity.
Identifiers: *Finland.

Water quality studies of Finnish lakes and rivers from 1962-1973 showed that conductivity, chloride, and total sulfur had increased in running waters. Observations were insufficient to adequately describe the dynamic processes taking place. More changes were observed in the autumn than the spring. Leaching was important. Water quality changes were slightly more frequent in deep water than in running water. More changes were observed at 5 m depths and fewer changes in water near the bottom. Salt concentrations increased in many deep water stations; oxygen levels varied; total nitrogen sometimes increased; and alkalinity sometimes decreased. Water quality changes were more common in the great lake systems than in waters near the coast or in northern Finland waters. Water quality had deteriorated in some areas but seemed to be improving in other areas. Electrolytes were high in river systems in the south and southwest. Salts, sulfur, and chloride increases were less frequent in the great lakes and not observed near the southwest coast. Acidity decreased in rivers on the south and southwest coasts. Fewer changes were observed in waters on the Ostrobothnian coast than in Lake

Finland. Detailed tables of lotic and lentic waters show the trend of their components at the 95% confidence level. (Buchanan-Davidson-Wisconsin).
W76-06212

THE PLANKTONIC CRUSTACEANS OF MONCOVE LAKE, MONROE COUNTY, W. VA.,
Arizona State Univ., Tempe. Dept. of Zoology. W. W. Taylor.
Proceedings West Virginia Academy of Science, Vol. 46, p. 223-229, 1974. 4 tab., 9 ref.

Descriptors: *Reservoirs, *Crustaceans, *West Virginia, Varieties, *Daphnia, *Zooplankton, Oligotrophy, Dominant organisms.
Identifiers: *Moncove Lake (W. Va.), Bosmina longirostris, Alona, Daphnia catawba, Daphnia ambigua, Mesocyclops edax, Diaptomus pallidus.

Moncove Lake, West Virginia, a small impoundment used for sport fishing, was studied from August 1972-August 1973 to determine planktonic crustacean abundances and species composition. Samples were removed with replicate vertical tows from 0.5 m above the bottom at two sites. The crustacean community consisted of *Bosmina longirostris*, *Alona* sp., *Daphnia catawba*, *Daphnia ambigua*, *Mesocyclops edax*, and *Diaptomus pallidus*. Total crustacean abundance at both stations followed the same seasonal pattern, but changes were usually detected first at the upstream station. The upstream station contained a greater yearly mean crustacean density and more individuals/sq cm in summer; mean crustacean abundance during the growing season was not significantly different. *D. ambigua*, *D. catawba*, and *M. edax* were the dominant zooplankton at both stations, but abundances varied. *D. ambigua* and *M. edax* populations were highest at the upstream station; *D. catawba* was highest at the downstream station. Total crustaceans and individual abundance followed the same general pattern. *D. ambigua* was the first dominant species to reach maximum densities at both stations; *D. catawba* reached maximum density next at the lower station, followed by *M. edax*. The reverse was true at the upper station. Moncove Lake was considered oligotrophic. (Buchanan-Davidson-Wisconsin).
W76-06214

AQUATIC INSECTS OF WISCONSIN,
Wisconsin Univ., Madison. Dept. of Entomology. W. L. Hilsenhoff.
Wisconsin Department of Natural Resources Technical Bulletin N. 89, 1975. 53 p. 352 fig., 79 ref.

Descriptors: *Wisconsin, *Aquatic insects, *Systematics, Varieties, Ecology, Distribution, Stoneflies, Mayflies, Dragonflies, Caddisflies, Lacewings, Midges, Diptera, Water beetles, Insect control.
Identifiers: Megaloptera, Hemiptera, Neuroptera, Lepidoptera, Coleoptera.

Taxonomic advances have been made since keys to genera of insects in North America were published. Due to increased interest in the aquatic environment, generic keys have been prepared for aquatic insects occurring in Wisconsin. The keys are restricted to genera which are likely to be found in Wisconsin and include only the aquatic stages of these genera. General information on the biology, ecological requirements, distribution, and abundance of genera in Wisconsin is included. Each key has an appended list of species which occur in Wisconsin; species and genera that may occur but have not yet been collected are marked with an asterisk. References to recent keys to species that are not monotypic are included for most orders. Because of uncertainty in identification, no list of species is appended for Diptera, Lepidoptera, and Neuroptera. No effort was made to denote species of Ephemeroptera not collected in Wisconsin. Keys are presented for Plecoptera

(stoneflies), Ephemeroptera (mayflies), Odonata (dragonflies), aquatic Hemiptera (bugs), Trichoptera (caddisflies), Megaloptera (fishflies and alderflies), aquatic Neuroptera (spongilla flies), aquatic Lepidoptera (moths), aquatic Coleoptera (beetles), and aquatic Diptera (flies and midges). A glossary of terms used in the keys is included. (Buchanan-Davidson-Wisconsin).
W76-06215

ECOLOGY AND BIOGEOGRAPHY OF MAYFLIES (EPHEMEROPTERA) OF RUNNING WATERS IN THE POLISH PART OF THE CARPATHIANS. 1. DISTRIBUTION AND QUANTITATIVE ANALYSIS,
Jagellonian Univ., Krakow (Poland). Dept. of Hydrobiology. R. Sowa.
Acta Hydrobiologica, Vol. 17, No. 3, p. 223-297, 1975. 8 fig., 18 tab., 120 ref.

Descriptors: *Ecological distribution, *Biogeography, *Mayflies, *Rivers, *Distribution patterns, Physicochemical properties, Streams, Water levels, Velocity, Temperature, Turbidity, Hydrogen ion concentration, Hardness (Water), Oxygen, Varieties, Dominant organisms, Habitats, Seasonal, Speciation, Europe.
Identifiers: *Poland, *Carpathian Mountains (Poland), Nymphs.

Mayfly abundance and distribution were studied in running waters in the Polish portion of the Carpathian Mountains and in the territory bounded by the Vistula and San Rivers. Previous studies are also reviewed. Sixty-eight streams ranging from high mountain streams to lowland rivers were studied between 1958-1972. Each region and sampling station is carefully described and physicochemical environmental factors indicated, i.e., variations in water level and flows, current velocity, temperature, turbidity, pH, hardness, oxygen. Over 3346 winged mayflies and 100,000 nymphs belonging to 97 species were collected. Each species and the stations where they were found are listed. Comments are made where the nomenclature had changed or the identification seemed incorrect. This comprehensive investigation delineates the maximum range for each species, its distribution within the investigated area, and along specific water courses. Six different longitudinal zones were distinguished in the Sola, Skawica, Raba, and San catchments and the Dunajec and its tributaries from the Tatras and Groce, which were inhabited by five different mayfly nymph communities. They are identified as to species composition and dominance. The quantitative distribution of mayflies is indicated at five habitats in the River Raba catchment area at various seasons. (Buchanan-Davidson-Wisconsin).
W76-06216

THE RELATIONSHIPS OF PHOSPHORUS AND NITROGEN TO THE TROPHIC STATE OF NORTHEAST AND NORTH-CENTRAL LAKES AND RESERVOIRS.
Pacific Northwest Environmental Research Lab., Corvallis, Oreg.
Available from the National Technical Information Service, Springfield, Va 22161 as PB-240 937, \$4.00 in paper copy, \$2.25 in microfiche. Working Paper No. 23, December 1974. 40 p. 7 fig., 14 ref., 2 append. 1BA029

Descriptors: *Eutrophication, *Trophic level, *Phosphorus, *Nitrogen, Lakes, Northeast U.S., Chlorophyll, Nuisance algae, Secchi disks, Algae, Depth, Limiting factors, Nutrients, Connecticut, Maine, Massachusetts, Michigan, Minnesota, New Hampshire, New York, Rhode Island, Vermont, Wisconsin.
Identifiers: *Phosphorus input guidelines, *North-central U.S., National Eutrophication Survey.

National Eutrophication Survey data collected during 1972-1973 from lakes and reservoirs in ten

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northeast and north-central states were used to describe relationships between total phosphorus concentrations and chlorophyll in phosphorus-limited lakes, which were used to establish phosphorus guidelines (20-30 micrograms total phosphorus/l) to avoid nuisance phytoplankton blooms. Oligotrophic and mesotrophic lakes had chlorophyll concentrations less than 12 micrograms/l. Secchi disc readings (in eutrophic lakes) were less than 2 m, above 6.6 feet in mesotrophic lakes, and above 11.8 feet in oligotrophic lakes. Relationships between median fall total phosphorus concentrations and algal yields suggested a total phosphorus guideline of 25 micrograms/l to maintain algae-free conditions. Using Vollenweider's concept, total phosphorus loading guidelines were established for phosphorus-limited lakes and reservoirs. Loading limits were established for each lake based on mean depth and hydraulic retention time. A relationship deriving total nitrogen-loading guidelines for nitrogen-limited lakes was developed. All nitrogen-limited lakes studied were eutrophic, indicating that usually nitrogen-limitation does not occur until a lake is highly enriched. These guidelines plus knowledge of nutrient levels, land use, lake use, and lake morphometry can be used to establish enforceable nutrient criteria and to avoid nuisance algal bloom conditions. (Buchanan-Davidson-Wisconsin). W76-06220

NATIONAL EUTROPHICATION SURVEY METHODS FOR LAKES SAMPLED IN 1972.
Pacific Northwest Environmental Research Lab., Corvallis, Oreg.
Available from the National Technical Information Service, Springfield, Va 22161 as PB-240 936, \$4.00 in paper copy, \$2.25 in microfiche. Working Paper No. 1, October 1974. 44 p. 4 tab., append. 1BA029

Descriptors: *Eutrophication, *Surveys, *Sampling, *Analytical techniques, Chemical properties, On-site tests, Precipitation (Atmospheric), Streams, Sewage effluents, Septic tanks, Northeast U.S., Stream flow, Runoff, Drainage area, Lakes, Bioassay, Nutrients, Algae, Minnesota, Michigan, Wisconsin, New York, Connecticut, Massachusetts, Rhode Island, Delaware, New Hampshire, Maine.
Identifiers: *Nutrient sources, *National Eutrophication Survey, Selenastrum capricornutum, Nutrient loads.

The chemical, physical, and biological methods and other procedures used by the National Eutrophication Survey for studying lakes, streams, and municipal sewage treatment plant effluents in ten northeastern states are described. Estimates of streamflows and runoff for streams and drainage areas for each stream, lake or reservoir were made. Lake tributary and outlet nutrient loads were estimated for an average flow year. Using regression analysis, the results showed annual loading values generally within a few percent of the loading which would be estimated if it were assumed that nutrient concentrations did not vary with changes in stream flow. Usually 100% of point-source loads eventually reached the lake or reservoir. Nutrient contributions of unsampled portions of drainage areas were estimated by using the average nutrient export per unit area of sampled stream drainage and multiplying that by the area of the unsampled portion. When sewage plant effluents were not sampled, nutrient loads were estimated on the basis of 100 gallons/capita/day. Total phosphorus and nitrogen contributions were also estimated on a per capita/year basis. Algal assay tests were conducted with Selenastrum. Phytoplankton was identified and counted, and the most prevalent genera and total counts per ml were tabulated for each lake sampled. (Buchanan-Davidson-Wisconsin). W76-06221

A METHOD OF DETERMINING MORPHOPHYSIOLOGICAL INDICATORS IN THE ECOLOGY OF ROTIFERS (ROTATORIA), (IN RUSSIAN).
For primary bibliographic entry see Field 5A.
W76-06231

A CONTINUOUS FLOW APPARATUS FOR THE CULTURE OF FILAMENTOUS GREEN ALGAE,
University Coll. of South Wales and Monmouthshire, Cardiff. Dept. of Botany.
N. B. Prance, and K. Benson-Evans.
Br Phycol J. 8(1): 59-63. Illus. 1973.

Descriptors: Algae, *Chlorophyta, *Cultures, Plant growth, *Experimental models.
Identifiers: Ulothrix-Zonata, Filamentous algae, Green algae.

An apparatus is described in which filamentous algae can be grown under conditions of continuous flow at river levels of nutrients and be harvested at the end of an experimental period. Details of a trial experiment involving the culture of Ulothrix zonata (Weber et Mohr) Kutz. are given. Copyright 1974, Biological Abstracts, Inc.
W76-06244

OBSERVATIONS ON BLOOMS OF THE DINOFLAGELLATE GYRODINIUM AU-REOLUM HULBURT IN THE RIVER CONWAY AND ITS OCCURRENCE ALONG THE NORTH WALES COAST,
Ministry of Agriculture, Fisheries and Food, Conway (Wales). Fisheries Experiment Station.
D. Ballantine, and F. M. Smith.
Br Phycol J. 8(3): 233-238. Illus. 1973.

Descriptors: Europe, *Dinoflagellates, *Flowering, Plant growth regulators, Eutrophication.
Identifiers: Blooms, Conway River, Dinoflagellate, Gyrodinium-Aureolum, Wales.

A water bloom was observed in the River Conway and along the North Wales coast in Oct. 1971. The course of the bloom was measured by counts and an investigation made of the distribution of the causative organism and its identification. It is considered to be G. aureolum Hulburt, though there are minor differences from the type. Copyright 1974, Biological Abstracts, Inc.
W76-06245

PHYTOPLANKTON BIOMASS AND DISTRIBUTION IN A SHALLOW EUTROPHIC LAKE (LAKE GEORGE, UGANDA),
Vienna Univ. (Austria). Limnologische Lehrkanzel.
G. G. Ganf.
Oecologia (Berl). 16(1): 9-29. Illus. 1974.

Descriptors: *Phytoplankton, *Biomass, Lakes, *Eutrophication, Flow, Fluid movement, Africa.
Identifiers: Anabaena, Lake George, Melosira, Uganda, Water movement.

Lake George, a shallow lake in western Uganda, supports a permanent and dense crop of phytoplankton, and may be regarded as eutrophic although the ambient concentrations of inorganic N and P are low. The figures for the annual nutrient loadings (Viner and Smith, 1973) would suggest, however, a eutrophic lake when analyzed on the scheme of eutrophication proposed by Vollenweider (1968). The horizontal distribution of chlorophyll a shows a concentric pattern, with the maximum values occurring towards the center. This horizontal variation is thought to reflect water movements, and a general pattern of water flow is proposed. The majority of the species show no seasonal variation but populations of both Anabaena and Melosira show annual variations. These 2 spp. also have a horizontal distribution pattern which is the reverse of other species. This

pattern is used to support that proposed movements of water. Phytoplankton generation times are discussed in relation to the diurnal cycle occurring in Lake George. Copyright 1974, Biological Abstracts, Inc.
W76-06246

N AND P DISTRIBUTION IN LAKE KINNERET (ISRAEL) WITH EMPHASIS ON DISSOLVED ORGANIC NITROGEN,
Israel Oceanographic and Limnological Research Ltd., Haifa; and Kinneret Limnology Lab., Tiberias (Israel).
For primary bibliographic entry see Field 5B.
W76-06268

AN APPROACH TO A WATER QUALITY INDEX FOR CANADA,
Department of the Environment, Ottawa (Ontario). Science Policy Branch.
For primary bibliographic entry see Field 5G.
W76-06272

IMPACT OF THE SEWAGE WORKERS' STRIKE ON THE RIVER CLYDE,
Clyde River Purification Board, Glasgow (Scotland).
D. Hammerton.
Effluent and Water Treatment Journal, Vol. 15, No. 6, p 278-287, June 1975. 4 fig, 1 tab, 1 ref.

Descriptors: *Water quality, *Sewage treatment, *Sewage effluents, *Aeration, Pollution, Waste dilution, Flow augmentation, Oxygen demand, Aquatic populations, Water pollution effects.
Identifiers: *River Clyde (Scotland).

From October 7 to December 2, 1974, 120 workers at three Scottish sewage treatment plants went on strike and during that time about 450 megaliters per day of untreated liquid residuals were discharged into the River Clyde. The main concern was public health, that is, to see that sewers did not become overloaded and that crude sewage did not flow onto the streets. A major effort to monitor damage to water quality was made. In addition to obvious contamination at each sewage outfall, there was a marked rise in suspended solids, ammonia and BOD values, with a resultant decrease in dissolved oxygen. In the middle of October oxygen declined rapidly but two days of heavy rainfall increased oxygen concentrations to very safe levels and averted a salmon kill. Two methods of aerating river water were tried on a small scale. Two oxygen injection units were capable of injecting from 1/2 to 1 and 1/2 tons of oxygen per day and were effective, but two floating aerator units did little, probably because the units did not mix water sufficiently. Impact on plants and animals was less than might be expected which emphasizes the fact that conditions on the bottom rather than those in the water determine the ability of life forms to survive. The river recovered in about six months. There was no real threat to public health during the strike because of relatively high water flows (but not high enough to flood streets fortunately), lowered water temperatures, and the fact that treatment plants and rivers were not affected where river water is used for recreation and water supply. Aquatic eco-systems can recover from severe or catastrophic short-term pollution much more rapidly than from lower levels of chronic pollution. (Smith - North Carolina)
W76-06281

PRODUCTION OF PLANKTONIC CRUSTACEANS OF TWO SECONDARY OLIGOTROPHIC LAKES, (IN RUSSIAN),
Gorki State Univ. (USSR).
M. A. Petrova, T. S. Elagina, V. K. Spiridonov, and T. A. Filatkina.
Gidrobiol Zh 11(1), p 82-86. 1975.

Descriptors: *Production, *Crustaceans, *Plankton, Lakes, *Oligotrophy, Biomass, Daphnia, Entrophication, Water pollution effects. **Identifiers:** Bosmina-Coregoni, Bosmina-Kessleri, Daphnia-Longispina, Diaphanosoma-Brachyurum, Diaptomus-Gracilis, Mesocyclops-Leuckartii, *USSR.

Two lakes, 1 in the NE and the other in SW of the Gorki Oblast of the Russian SFSR (USSR) were studied. Morphometric indices of the lakes, and the numbers, absolute and relative biomass, fecundity, size and duration of development, production (P), biomass (B) and P/B ratios of crustaceans (*Diaptomus gracilis*, *Daphnia longispina*, *Mesocyclops leuckartii*, *Bosmina coregoni*, *B. kessleri* and *Diaphanosoma brachyurum*) in these lakes are presented.—Copyright 1975, Biological Abstracts, Inc. W76-06301

CHLORINATION IN DILUTE AQUEOUS SYSTEMS; 2,4,6-TRICHLOROPHENOL, Waterloo Univ. (Ontario). Dept. of Chemistry. For primary bibliographic entry see Field 5B. W76-06306

SIGNIFICANCE OF TRACE METALS AND NITRATES IN SLUDGE SOILS, Environmental Protection Agency, Columbus, Ohio. Div. of Waste Management and Engineering. For primary bibliographic entry see Field 5E. W76-06307

HYDROLOGICAL AND HYDROGEOLOGICAL ASSESSMENT OF LANDFILL SITES, For primary bibliographic entry see Field 5E. W76-06315

STAGNOSPORA FOLICOLA, A PATHOGEN OF REED CANARYGRASS SPRAY-IRRIGATED WITH MUNICIPAL SEWAGE EFFLUENT, Agricultural Research Service, University Park, Pa. Regional Pasture Research Lab. For primary bibliographic entry see Field 5E. W76-06318

HEALTH SIGNIFICANCE OF AIRBORNE MICROORGANISMS FROM WASTEWATER TREATMENT PROCESSES, PART I: SUMMARY OF INVESTIGATIONS, North Carolina Univ., Chapel Hill. Dept. of Environmental Sciences and Engineering. J. L. S. Hickey, and P. C. Reist. *Journal Water Pollution Control Federation*, Vol. 47, No. 12, p 2741-2757, December, 1975. 54 ref.

Descriptors: *Public health, *Aerosols, *Treatment facilities, Bacteria, Pathogenic bacteria, Coliforms, Air pollution effects, Path of pollutants, Reviews, Microorganisms. **Identifiers:** Air pollution sources, Aerated waste water treatment.

This report summarizes 16 published reports representing 13 separate field studies, all that could be found in English, of airborne microorganisms from waste water treatment processes. The earlier studies, from 1907 to the 1950's, established that bacteria was spread by aerosolization from waste water flowing in sewers, sludge aeration tanks, and trickling filters. In 1966, it was shown that trickling filters yielded twice as many coliforms as other plant units, and that half the particles were less than 5 microns in diameter. In a different test, it was calculated that this particle size could penetrate the lungs and that the number of small particles increased with some distance from the waste water sources. Later it was decided that the small aerosols could penetrate both the bronchia and the upper respiratory tract. Aerosol dispersion patterns, taking into consideration the

direction of wind, were made. In 1973, a test was undertaken in which bacteria were recovered from various airs around a plant and guinea pigs were inoculated with the organisms. Within 6 weeks the guinea pigs developed lesions. Another study concluded that solar radiation, low relative humidity, and low wind speed reduced aerosol emissions. One report suggested that coliforms may not be a reliable index of air pollution arising from waste water aeration and that total colony count may be a more accurate measure. Some of the reports made conclusions about possible health hazards, but the totality of the significances on health are summarized in the second part of the article. (See also W76-06327) (Loustau-FIRL) W76-06326

HEALTH SIGNIFICANCE OF AIRBORNE MICROORGANISMS FROM WASTE WATER TREATMENT PROCESSES, PART II: HEALTH SIGNIFICANCE AND ALTERNATIVES FOR ACTION, North Carolina Univ., Chapel Hill. Dept. of Environmental Science and Engineering. J. L. S. Hickey, and P. C. Reist. *Journal Water Pollution Control Federation*, Vol. 47, No. 12, p 2758-2773, December, 1975. 4 tab, 77 ref.

Descriptors: *Public health, *Treatment facilities, *Aerosols, Bacteria, Pathogenic bacteria, Path of pollutants, *Air pollution effects, Microorganisms. **Identifiers:** Aerated waste water treatment, Air pollution sources.

The emission and spread of viable bacterial aerosols from aerated waste water processes has been demonstrated in numerous studies. These aerosols contain a variety of virulent, pathogenic, bacterial genera and species in particles within the human respirable size range for both upper and lower respiratory tract deposition. Present evidence does not, however, confirm or negate the existence of a health risk. Further investigation of health effects is necessary, and concurrent development and evaluation of viable aerosol control measures could be helpful. Environmental monitoring is not of much value without further studies on the health aspects of aerosols. Nonetheless, waste water plant operators and health professionals should be informed of the potential risks from waste water aerosols. These conclusions were drawn from an overall assessment of the results and conclusions of studies into the airborne microorganisms. The studies included field and laboratory investigations, reviews, and surveys from 1907 to 1975. (See also W76-06326) (Loustau-FIRL) W76-06327

NUTRITIONAL AND PHYSIOLOGICAL EFFECTS OF NITRATES, NITRITES, AND NITROSAMINES, Florida Univ., Gainesville. Dept. of Animal Science. R. L. Shirley. *BioScience*, Vol. 25, No. 12, p 789-794, December, 1975. 81 ref.

Descriptors: *Septic tanks, *Waste water treatment, *Fertilizer, *Sewage treatment, *Lakes, Nitrates, Nitrites, Eutrophication, Toxicity, Potable water, Animal diseases. **Identifiers:** Nitrosamines, Carcinogens.

Areas of high concentrations of livestock, heavy fertilizer application, septic tanks, and sewage plant outflow may produce excessive quantities of nitrates in animals' drinking water and eutrophication of lakes. Nitrates and nitrites consumed in diets of animals are being studied as toxic factors for the animals. Ruminants have greater tolerance of nitrate and nitrite than human infants, but a potential danger still exists. Nitrates have been demonstrated to lessen formation of toxins when

added to meat products that contain various toxin-producing microbes. On the other hand, in the presence of various amines in meat and other foodstuffs, nitrites have been demonstrated to produce carcinogenic nitrosamines. Bacteria in the alimentary tract produce nitrosamines from nitrite and amines derived from lecithin and proline. Because experimental doses exceed the concentrations that normally appear, it is not known whether the potential sources of nitrosamines have actually produced cancer in animals. Tests on rats showed that nitrosamines produced cancer in the digestive, urinary, and respiratory tracts, as well as in the liver and reproductive tissues. (Loustau-FIRL) W76-06334

EFFECTS OF SALINITY ON NITRIFICATION IN THE EAST RIVER, New York State Dept. of Health, Albany. Div. of Labs. and Research; New York State Dept. of Health Albany. Environmental Health Center. M. Chen, E. Canelli, and G. W. Fuhs. *Journal Water Pollution Control Federation*, Vol. 47, No. 110, p 2474-2481, October, 1975. 3 fig, 3 tab, 25 ref.

Descriptors: *Ammonia, *Nitrites, *Waste water treatment, *Nitrification, *New York, Sampling, Bacteria, Rivers, *Salinity, Environmental effects, Chemical analysis, Waste assimilative capacity. **Identifiers:** East River(NY).

Due to known high concentrations of ammonia and nitrite from discharges of waste water treatment plants into New York Harbor, a study was done to determine the rate of nitrification in the East River and to determine the NaCl tolerance of the nitrifying bacteria. Water samples were collected from 12 sites along the East River each week for about three months. Media were prepared with the river dilutions to represent the concentrations of calcium, magnesium, phosphorus, and iron in the undiluted East River water. The samples were incubated for 20 days and then portions were used as inocula. Colonies were selected and streaked twice for isolation. The results of chemical analysis showed that the rates of nitrification in samples from the East River are increased when the samples are diluted with suitable media prepared with distilled water. The rates of nitrification in samples from the southern or central parts of the East River are higher than those in samples near the sound. Both NaCl and some unknown substances in the filtrate portion of the water seem to inhibit nitrification in the East River. Nitrifying bacteria isolated from the East River were not halophilic. Most nitrifying bacteria in the East River are therefore apparently of terrestrial origin. (Loustau-FIRL) W76-06335

RELATIONSHIP BETWEEN VARIOUS BACTERIAL POPULATIONS AND COPROSTANOL AND CHOLESTEROL, Canada Centre for Inland Waters, Burlington (Ontario). B. J. Dutka, and A. El-Shaarawi. *Canadian Journal of Microbiology*, Vol. 21, No. 9, p 1386-1398, September, 1975. 3 fig, 9 tab, 19 ref.

Descriptors: *Viruses, *Model studies, *Coliforms, *Bacteria, *Public health, Treatment facilities, Flocculation, Sampling, Statistical analysis. **Identifiers:** *Coprostanol, *Cholesterol.

Since fecal matter in water can carry hazardous viruses, finding traces of coprostanol and cholesterol in raw waters, indicating the presence of fecal matter in water, could be important to public health. A one-year study evaluated the relationship between coliforms, fecal coliforms, fecal streptococci, heterotrophs, and coprostanol and cholesterol. Sewage samples were collected from

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four treatment plants, one that chlorinated clarifier effluent, one that chlorinated water before flocculation and added lime to the clarifier tank, one that chlorinated final effluent, and one that chlorinated raw sewage. Water samples were analyzed bacteriologically, and fecal sterol samples were analyzed chemically. Reduction in fecal-sterol levels ranged from 46.93% to 99.81%. A significant relationship existed between coprostanol and cholesterol in all three phases of the sewage-treatment processes. No significant relationships were found to exist between fecal sterols and bacterial parameters in the raw-sewage streams. However, in treated unchlorinated sewage a significant relationship was observed between most bacterial parameters and fecal sterols. A statistical model using the collected data indicated that coprostanol and cholesterol have a high positive correlation, thus supporting the concept that either sterol could be used as an indicator of fecal pollution. (Loustau-FIRL)

W76-06336

USE OF SEWAGE SLUDGE ON AGRICULTURAL LAND AND THE EFFECTS OF METALS ON CROPS, Agricultural Development and Advisory Service, Wolverhampton (England).

J. H. Williams.
Water Pollution Control, Vol. 74, No. 6, p 635-644, 1975. 10 tab, 7 ref.

Descriptors: *Sewage sludge, *Nitrogen, *Phosphate, *Fertilizer, Toxicity, Heavy metals, Soils, Zinc, Nickel, Copper, Lead, Mercury, Cadmium, Environmental effects, Industrial wastes.
Identifiers: Land application.

Sewage sludges, and particularly liquid digested sludges, are valuable sources of available nitrogen and phosphate, if they are applied in spring when the growing crop can utilize them. Sewage sludge containing industrial wastes must be applied carefully, and sludges that may be toxic are unsuitable for agricultural use. Once a harmful concentration of these toxic metals is built up in soils, the effect can be permanent. Zinc and nickel are absorbed by plant roots and translocated within the plant. Copper becomes concentrated in the roots. Very little of the total lead in the soil is absorbed by plants and it remains in the roots; although it does not seem to affect plant growth, it could harm animals or humans if abnormal amounts are accumulated. Although not enough is known about the behavior of mercury and cadmium, cadmium probably is a risk because it is readily taken up by the roots, and mercury probably is not because its percentage in sludge is so small. (Loustau-FIRL)

W76-06339

REVEGETATING BITUMINOUS STRIP-MINE SPOILS WITH MUNICIPAL WASTEWATER, PART II: QUALITY THE LEACHEATE AND SPOIL CHEMICAL CHANGES, Pennsylvania State Univ., University Park. Dept. of Forest Hydrology.

For primary bibliographic entry see Field 5D.
W76-06343

EXAMINATION OF SEWAGE AND SEWAGE SLUDGE FOR ENTEROVIRUSES, VOLUME I. Ontario Ministry of Health, Toronto.

For primary bibliographic entry see Field 5A.

W76-06371

NUTRIENT TRANSFORMATIONS IN MASS CULTURES OF MARINE ALGAE, Woods Hole Oceanographic Institution, Mass. Dept. of Biology.

J. C. Goldman, and J. H. Ryther.
Journal of the Environmental Engineering Division, Proceedings of the American Society of Civil Engineers, Vol. 101, No. EE3, Proceedings paper No. 11358, p 351-364, June 1965. 8 fig, 2 tab, 22 ref.

Descriptors: *Algae, *Marine algae, *Environmental engineering, *Nutrients, Ammonia, Geographical regions, Nitrogen, Phosphorus, Sea water, Waste water(Pollution).
Identifiers: *Algal nutrients.

Two mass cultures of marine algae were maintained for 24 continuous weeks on mixtures of secondarily treated wastewater and seawater. Nitrogen removal and algal growth were related to both nitrogen loading in the form of variations in the waste-seawater mixture and changes in the dilution rate. Nitrogen assimilation was limited to about 4 mg/l. High nitrogen removals were associated with a combination of algal assimilation and ammonia evolution at the high pond pH values attained. Algal concentrations represented as both particulate carbon (PC) and particulate nitrogen (PN) decreased linearly with increases in the dilution rate. Maximum algal yields of 6 g PC m⁻² day⁻¹ occurred at a dilution rate of 0.75 day⁻¹. (Bell-Cornell)

W76-06441

ACROLEIN RESIDUES IN IRRIGATION WATER AND EFFECTS ON RAINBOW TROUT, Bureau of Reclamation, Denver, Colo. Engineering and Research Center.

T. R. Bartley, and A. R. Hattrup.
Report REC-ERC-75-8, May 1975. 13 p, 3 fig, 5 tab, 11 ref.

Descriptors: *Herbicides, Aquatic, Weed control, Irrigation systems, *Rainbow trout, Mortality, Analysis, Water samples, Treatment, Washington, Pesticide residues, Columbia River, Irrigation water.
Identifiers: Columbia Basin Project(WA), *Acrolein.

Studies were conducted on the Columbia Basin Project, Washington, to determine the concentrations of acrolein in irrigation water at several sampling stations during 20 applications of the herbicide for aquatic weed control and at the Bureau of Reclamation's Carter Lake, Colorado Aquatic Weed Test Station to find the effects of simulated acrolein treatment on rainbow trout. Analysis of samples of treated irrigation water shows that the actual acrolein concentrations near application sites agree with the computed levels and that the concentrations decline gradually as the treated water moves downstream. Applications of about 0.1 p/m for 48 hours with one booster application require a distance of 30 to 40 miles (48.3 to 64.4 km) to reduce concentration to the 0.02 p/m level. Acrolein concentrations used for aquatic weed control are toxic to rainbow trout. Acrolein concentrations of 0.2 and 0.02 p/m for exposure periods of 4.8 and 48 hours respectively, are levels considered to be reasonably safe to trout. (Bureau of Reclamation)

W76-06563

THE GREEN BAY WATERSHED - PAST/PRESENT/FUTURE, Wisconsin Univ., Madison Inst. for Environmental Studies.

G. Bertrand, J. Lang, and J. Ross.
Report WIS-SG-76-229; January 1976, 319 p.

Descriptors: *Environment, *Ecology, *Ecosystems, *Lake Michigan, Aquatic environment, Biological communities, Water pollution, Water quality, *Wisconsin, Michigan, Bays, Natural resources, Water pollution effects.
Identifiers: *Green Bay watershed(Wisc), Green Bay ecosystem(Wisc), Resources use, Pollution control.

Green Bay is a major geographic feature of Wisconsin and Michigan. It is a significant natural resource. It is a recreation area, a fishery, a commercial waterway, and it contains a highly productive biological system. Since the time of settlement, 150 years ago, the Green Bay system has

been changed drastically. The changes are largely the result of two major activities: (1) heavy use of resources in the region; and (2) use of the surface water as a pollution sink, causing a progression of poor quality water up the bay from south to north as time goes on. The interaction of resource use and pollution has caused a depletion of natural resources, including some that would have the capacity to renew themselves under less stress. But it has also vastly changed the population dynamics of an array of living species in the bay. It is possible that a critical point of change is being reached in the condition of Green Bay. (NOAA)

W76-06569

SUMMARY AND CONCLUSIONS: NUTRIENT TRANSPORT AND ACCOUNTABILITY IN THE LOWER SUSQUEHANNA RIVER BASIN, Environmental Protection Agency, Annapolis, Md. Annapolis Field Office.

For primary bibliographic entry see Field 5B.
W76-06575

EFFECT OF SALINIZATION ON CERTAIN SOIL MICROFLORA,

Institute for Applied Research on Natural Resources, Baghdad(Iraq).
A. N. Yousef, S. M. Damirji, I. J. Al-Khalili, and A. M. Al-Zubair.
Technical Bulletin 83, August, 1975. 27 p, 6 fig, 9 tab, 18 ref.

Descriptors: *Saline soils, *Clostridium, *Nitrogen fixing bacteria, *Sulfur bacteria, *Azotobacter, Salinity, Salts, Sulfates, Saline water, Soil microorganisms, Soil bacteria, Nitrification, Soil analysis, Salt tolerance, Fertility.
Identifiers: *Al-Damag province(Iraq).

The effect of soil salinity was studied on total microbial count, non-symbiotic nitrogen-fixing Azotobacter and clostridia, nitrifiers, and sulfate reducing bacteria. Three treatments were prepared: non-saline soil supplied with distilled water, non-saline soil supplied with saline groundwater, and saline soil supplied with distilled water. Soil samples were analyzed at 45-day intervals for one year from 0-30 and 30-60 cm depths. In the non-saline and saline soils supplied with distilled water, most of the salts accumulated within the first sampling intervals in the 0-30 cm layer. Salts accumulated gradually in both layers for the non-saline soil supplied with saline groundwater. The effect of salts on soil microflora depends on the quantity and quality of the salts. Azotobacter and the nitrifiers were more affected by salinization than the clostridia. The number of sulfate reducers for all treatments was higher in the 30-60 cm layer. The total microbial count and the count of other bacteria groups showed no marked difference in the upper and lower layers. When salt accumulated in the upper layers, the counts were greater in the lower layers. (Robinet-Arizona)

W76-06582

THE MEDICINE BOW ECOLOGY PROJECT: THE POTENTIAL SENSITIVITY OF VARIOUS ECOSYSTEM COMPONENTS TO WINTER PRECIPITATION MANAGEMENT IN THE MEDICINE BOW MOUNTAINS, WYOMING, Wyoming Univ., Laramie.

D. H. Knight.
February 28, 1975, 397 p. 14-06-D-7198

Descriptors: Baseline studies, *Cloud seeding, Ecology, Ecosystems, *Wyoming, *Weather modification, Forests, Hydrographs, Silver iodide, Snowmelt, Snow management, Toxicity, Deer, Elk, Fish, Aquatic animals, Aquatic algae, Trout, Vegetation.
Identifiers: *Medicine Bow Ecology Project(Wyo).

In addition to baseline data, the Report includes (1) the results of studies on the impact of snow on

herbaceous and shrubby vegetation, elk, deer, trout, lake phytoplankton, and litter decomposition; and (2) the movement of Ag in an alpine ecosystem, the natural concentration of Ag at 20 locations in the Mountains, and the toxicity of Ag to tufted hairgrass, lodgepole pine seedlings, and rainbow trout. Ecological changes resulting from cloud seeding probably will be very slow, assuming that annual snowfall will be increased by only about 15 percent and only above about 2700 m elevation, and that snow cover duration will be prolonged by only a few days, if at all. The general discussion emphasizes the need for accurate information on the amount, distribution, and duration of the additional snow produced by cloud seeding in order to accurately evaluate impact; the fact that cloud seeding will be but one of several human influences on the ecosystems; and that there is the potential for indirect, undesirable impacts on areas downstream from where the seeding occurs. Six recommendations are listed that seem desirable from an ecological perspective, and information gaps are identified. (Bureau of Reclamation)
W76-06610

CORRELATION OF RADIOACTIVE WASTE TREATMENT COSTS AND THE ENVIRONMENTAL IMPACT OF WASTE EFFLUENTS IN THE NUCLEAR FUEL CYCLE FOR USE IN ESTABLISHING 'AS LOW AS PRACTICABLE' GUIDES--APPENDIX A. PREPARATION OF COST ESTIMATES FOR VOLUME 1, MILLING OF URANIUM ORES.
Oak Ridge National Lab., Tenn.
For primary bibliographic entry see Field 5D.
W76-06614

WATER QUALITY MODEL FOR SMALL AGRICULTURAL WATERSHEDS.
West Virginia Univ., Morgantown.
For primary bibliographic entry see Field 5B.
W76-06641

TAXONOMY OF KLEBSIELLA PNEUMONIAE ISOLATED FROM PULP/PAPER MILL WASTE-WATER.
Pacific Northwest Environmental Research Lab., Corvallis, Oreg.
M. D. Knittel.
Available from the National Technical Information Service, Springfield, Va 22161, as PB-244 405, \$4.00 in paper copy, \$2.25 in microfiche. Report EPA-660/2-75-024, June 1975. 31 p, 6 fig, 7 tab, 22 ref. 1BB037.

Descriptors: *Microbiology, Isolation, *Pulp wastes, Cultures, Classification, *Systematics, Chemical reactions, Pollutant identification.
Identifiers: *Klebsiella pneumoniae, *DNA.

K. pneumoniae isolated from pulp mills was compared to clinical isolates of K. pneumoniae. Cultures were identical in biochemical reaction in various media and conformed to the recognized schemes of classification of K. pneumoniae. Nucleic acid base composition comparison of these isolates showed that all exhibited a G+C% base composition of 56%+ or minus 1.4%, and all cultures examined fell within this range. A study of the heterologous binding capability between DNAs of these cultures revealed that isolates from both the environment and pathogenic reference had a base sequence from 80 to 100% in common. This confirms the earlier results that pulp mill isolates are the same as clinical isolates. (EPA)
W76-06645

AN ASSESSMENT OF THE EXPECTED IMPACT OF A DREDGING PROJECT PROPOSED FOR PALA LAGOON, AMERICAN SAMOA.
Hawaii Univ., Honolulu. Sea Grant Program.
For primary bibliographic entry see Field 6G.
W76-06654

BIOSTIMULATION AND NUTRIENT ASSESSMENT.

Utah Water Research Lab., Logan.
Workshop proceedings PRWG168-1, September 10-12, 1975, Water Research Laboratory, Utah State Univ., Logan, November 1975. Edited by E. J. Middlebrooks, D. H. Falkenberg, and T. E. Maloney. 396 p. R-903523 01.

Descriptors: *Algae, *Bioassay, *Analytical techniques, Growth rates, Nutrient requirements, Laboratory tests, Eutrophication, Toxicity, Limiting factors, Cultures, Model studies, Sampling, Biomass, Waste water(Pollution), Dredging, Anabaena, Water analysis, Management, Sediment-water interfaces, Sediments, Ecosystems, Hardness(Water), Phosphorus, Disposal, Lakes.
Identifiers: *Algal Assay Procedure, *Algal growth potential, *Selenastrum capricornutum, Anabaena flos-aquae.

The application of the Algal Assay Procedure: Bottle Test and its modifications are discussed in relation to various ecological and environmental variables. Contributions focus on the application of the test in biostimulation and toxicity testing; field evaluation of the test on surface waters of North Carolina; its application to define the effects of wastewater effluents upon algal growth in multiple use river systems; and the relationship of laboratory algal assays to measurement of indigenous phytoplankton in Long Lake, Washington. The test's applicability to compare algal growth responses of *Selenastrum capricornutum* and *Anabaena flos-aquae* in waters collected from Shagawa Lake, Minnesota; seasonal variation of algal biomass production potential and nutrient limitation in Yaquina Bay, Oregon; and algal nutritional bioassays of Lake Wylie, North Carolina, is described. Nutrient assessments as a basis for lake management priorities, as applied to Wisconsin lakes, is reviewed. Other contributions compare semi-continuous and continuous flow bioassays; the effects of media modifications upon *S. capricornutum* in batch cultures; sediment-water microcosms designed for assessment of nutrient interactions; effects of water hardness, phosphorus concentration and sample pretreatment on the test; and a elutriate method to determine the significance of dredged material disposal in open waters. (See W76-06697 thru W76-06709) (Auen-Wisconsin).
W76-06696

APPLICATION OF THE ALGAL ASSAY PROCEDURE IN BIOSTIMULATION AND TOXICITY TESTING.

Procter and Gamble Co., Cincinnati, Ohio.
A. G. Payne.
In: 'Biostimulation and Nutrient Assessment,' (PRWG168-1), workshop proceedings September 10-12, 1975, Logan, Utah, Water Research Laboratory, Utah State Univ., Logan, November 1975. p. 3-27. 18 fig, 10 ref.

Descriptors: *Eutrophication, *Algae, *Bioassay, *Analytical techniques, Algalicides, Trace elements, Lethal limit, Growth rates, Cultures, Measurement, Laboratory tests, Standing crops, Chelation, Sewage effluents, Zinc.
Identifiers: *Algal Assay Procedure, *Algal growth potential, *Microcystis aeruginosa*.

The Algal Assay Procedure combined with physical and chemical measurements is a dependable method to assess algal growth potential and show differences in nutrient concentrations between seasons. When oligotrophic water samples were filtered, inoculated, and maintained under laboratory conditions, they supported low algal standing crops all year. Natural populations of these waters also remained low all year. Eutrophic waters in winter supported high maximum standing crops of test algae and high natural populations in spring. The Algal Assay Procedure indicated the relative chelating capacity of synthetic compounds, sewage effluent, and natural chelators in aquatic

environments. Laboratory-cultured *Microcystis aeruginosa*'s sensitivity to low free metal levels is used in trace metal/chelator studies. Because the zinc level is close to the *Microcystis* toxicity level in Algal Assay Procedure media, it should be lowered for optimizing *Microcystis* growth. The method can also be used to determine algal toxicity of test materials. Results expressed in terms of minimum algalistic concentration after five days represent the test material level which does not cause net changes in test algae populations after chronic exposure, causes primary inhibitory effects at the cellular level, but does not cause permanent or irreversible damage to test cultures. (See also W76-06696) (Buchanan-Davidson-Wisconsin).
W76-06697

FIELD EVALUATION OF THE ALGAL ASSAY PROCEDURE ON SURFACE WATERS OF NORTH CAROLINA.

North Carolina Univ. at Chapel Hill. Dept. of Environmental Sciences and Engineering.
C. M. Weiss.
In: 'Biostimulation and Nutrient Assessment,' (PRWG168-1), workshop proceedings September 10-12, 1975, Logan, Utah, Water Research Laboratory, Utah State Univ., Logan, November 1975. p. 29-76. 1 fig, 34 tab, 11 ref.

Descriptors: *Eutrophication, *Algae, *Bioassay, *Analytical techniques, Growth rates, Measurement, On-site investigations, Trophic level, Laboratory tests, Nitrogen, Chlorophyll, Productivity, Phosphorus, Autoclaves, Filtration, Deficient elements, Biomass, Limiting factors, North Carolina.
Identifiers: *Algal Assay Procedure, *Algal growth potential, *Selenastrum capricornutum*.

To establish relationships between assays and existing trophic levels of water bodies, algal assays were made of 44 North Carolina water bodies. Cell density decreased with inorganic nitrogen increase; chlorophyll remained relatively constant; productivity reached a peak in middle concentration ranges. In the growing season soluble nitrogen showed an inverse relationship between cell number and nutrients. Phosphorus values varied but were higher in winter. Chlorophyll showed a positive relationship to cell density, productivity, and nitrogen. In the growing season there was a parallel increase in organic nitrogen and soluble phosphorus and increased productivity, cell density, and chlorophyll. *Selenastrum capricornutum* growth after autoclaving or filtering water samples indicated total and ambient growth potentials, respectively. Growth responses to added phosphorus or nitrogen compared to growth with original nutrient levels indicated nitrogen/phosphorus ranges. Soluble nitrogen/phosphorus determinations following limitation of either or both nutrients indicated that the ratio can define which nutrient is limiting for a particular water body. The standard assay procedure should be modified to limit the determination to biomass grown in reseeded samples after autoclaving and filtration. Whether a sample is limited in growth potential by the relative quantity of phosphorus or nitrogen can be determined from the total soluble nitrogen/phosphorus ratio. (See also W76-06696) (Buchanan-Davidson-Wisconsin).
W76-06698

APPLICATION OF ALGAL ASSAYS TO DEFINE THE EFFECTS OF WASTEWATER EFFLUENTS UPON ALGAL GROWTH IN MULTIPLE USE RIVER SYSTEMS.

Pacific Northwest Environmental Research Laboratory, Corvallis, Oreg. Eutrophication and Lake Restoration Branch.
W. E. Miller, J. C. Greene, and T. Shiroyama.
In: 'Biostimulation and Nutrient Assessment,' (PRWG168-1), workshop proceedings September 10-12, 1975, Logan, Utah, Water Research

Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

Group 5C—Effects Of Pollution

Laboratory, Utah State Univ., Logan, November 1975, p. 77-92. 9 fig, 11 ref.

Descriptors: *Eutrophication, *Algae, *Rivers, *Bioassay, *Analytical techniques, *Growth rates, Washington, Laboratory tests, Effluents, Waste water (Pollution), Toxicity, Phosphorus, Trophic level, Trace elements, Nitrogen compounds, Limiting factors, Heavy metals, Zinc.
Identifiers: *Algal growth potential, *Algal Assay Procedure, *Spokane River system (Wash), *Selenastrum capricornutum*.

To define effects of domestic and industrial waste discharges on algal growth in the Spokane River system, Washington, the design and interpretation of laboratory algal assays is discussed. Algal responses to nitrogen and phosphorus limitations, trace element deficiency, and heavy metal toxicity were determined. The critical nitrogen:phosphorus ratio to support *Selenastrum capricornutum* was 11.3:1 micrograms. This ratio can assess algal growth limitations in natural waters. Waters with N:P ratios less than 10 are considered nitrogen-limiting while waters with N:P ratios above 10 may be phosphorus-limiting for algal growth. Correlation of algal assays with yields predicted from N:P ratios depend on the reliability of test procedure. Total soluble inorganic nitrogen (nitrite + nitrate + ammonia) and orthophosphate concentrations or availability in samples were calculated by dividing maximum assay yields by the total soluble inorganic nitrogen or orthophosphate yield coefficient. That samples do not attain the predicted assay yield or nutrient limitation status may be due to growth-limiting nutrients other than nitrogen or phosphorus, presence of toxic materials, or unreliable chemical determinations of orthophosphate and total soluble inorganic nitrogen. Addition of EDTA before assay can help determine nutrient enrichment problems in river systems receiving heavy metal wastes. (See also W76-06696) (Buchanan-Davidson--Wisconsin).
W76-06699

THE RELATIONSHIP OF LABORATORY ALGAL ASSAYS TO MEASUREMENTS OF INDIGENOUS PHYTOPLANKTON IN LONG LAKE, WASHINGTON,
Pacific Northwest Environmental Research Lab., Corvallis, Oreg. Eutrophication and Lake Restoration Branch.
J. C. Greene, R. A. Soltero, W. E. Miller, A. F. Gasperino, and T. Shiroyama.
In: 'Biostimulation and Nutrient Assessment,' (PRWG168-1), workshop proceedings September 10-12, 1975, Logan, Utah, Water Research Laboratory, Utah State Univ., Logan, November 1975, p. 93-126. 17 fig, 7 tab, 30 ref.

Descriptors: *Eutrophication, *Algae, *On-site tests, *Bioassay, *Analytical techniques, Washington, Water pollution, Reservoirs, Growth rates, Heavy metals, Autoclaves, Filtration, Zinc, Chemical analysis, Lake morphology, Laboratory tests, Phosphorus compounds, Nitrogen compounds, Nutrients, Limiting factors, Mixing, Hydrologic aspects, Biomass, Chlorophyll, Standing crops.
Identifiers: *Algal growth potential, *Algal Assay Procedure, Long Lake (Wash), *Selenastrum capricornutum*.

To determine if laboratory algal assays of natural waters actually reflect environmental conditions, studies were made of *Selenastrum capricornutum* growth potential on autoclaved and filtered water from Long Lake, Washington. Increased algal yields in EDTA spiked test waters showed toxic levels of heavy metal(s). Maximum algal yields were more than twice the minimum biomass level indicating highly eutrophic water. Samples were primarily phosphorus-limited, but sometimes the reservoir was limited so closely by both nitrogen and phosphorus that the primary limiting nutrient could not be determined. Samples collected after an underflow destroyed thermal and chemical

stratification and induced extensive vertical mixing would not support algal growth in control or EDTA spiked samples; indigenous phytoplankton contained approximately half the normal chlorophyll concentration/unit volume. Correlation was high between indigenous phytoplankton and *S. capricornutum* dry weight if consideration was given to whether the reservoir was stratified or homothermal. An equation was developed to predict mean indigenous phytoplankton standing crops. If the reservoir is homothermal, the equation is useful to determine approximate indigenous phytoplankton standing crop at time of sampling; if stratified, it indicates the phytoplankton standing crop which was present approximately two weeks earlier. Another equation was developed to predict chlorophyll concentrations. (See also W76-06696) (Buchanan-Davidson--Wisconsin).
W76-06700

COMPARISON OF THE ALGAL GROWTH RESPONSES OF *SELENASTRUM CAPRICORNUTUM* PRINTZ AND *ANABAENA FLOSAQUAE* (LYNGB.) DE BREBISSEIN IN WATERS COLLECTED FROM SHAGAWA LAKE, MINNESOTA,

Pacific Northwest Environmental Research Laboratory, Corvallis, Oreg. Eutrophication and Lake Restoration Branch.
T. Shiroyama, W. E. Miller, and J. C. Greene.
In: 'Biostimulation and Nutrient Assessment,' (PRWG168-1), workshop proceedings September 10-12, 1975, Logan, Utah, Water Research Laboratory, Utah State Univ., Logan, November 1975, p. 127-148. 10 fig., 4 tab., 22 ref.

Descriptors: *Eutrophication, *Algae, *Bioassay, *Growth rates, *Anabaena, *Laboratory tests, Minnesota, Cultures, Analytical techniques, Phosphorus, Nitrogen, Inhibitors.
Identifiers: *Algal growth potential, *Algal Assay Procedure, *Selenastrum capricornutum*, Shagawa Lake (Minn.), *Anabaena flos-aquae*.

The growth response of *Anabaena flos-aquae* was studied to determine its reliability as a test alga and to compare its growth response to that of *Selenastrum capricornutum* in water samples from Shagawa Lake, Minnesota. Results showed that *A. flos-aquae* can be used as a test organism to define growth potential and nutrient status of lake waters. For counting, sonication was more efficient than blending to fragment *A. flos-aquae*, but it damaged cells so cannot be used to prepare an inoculum. Water containing more than 0.010 mg/l orthophosphate yielded 0.45 mg/l dry weight *A. flos-aquae* per 0.001 mg/l phosphorus. Filtered and autoclaved-filtered water samples were primarily nitrogen-limited for *S. capricornutum* support. The *A. flos-aquae* growth response indicated constituents other than nitrogen and phosphorus limited its growth in filtered samples; addition of phosphorus stimulated growth to the maximum predicted values in autoclaved-filtered samples. Comparative analysis of algal growth responses suggested that more than one test species should be used to determine the growth potential or nutritional status of a test water, if the presence of a biologically produced toxin is suspected. Filtered and autoclaved-filtered samples must be analyzed to determine the presence of a biologically produced growth-inhibitor. (See also W76-06696) (Buchanan-Davidson--Wisconsin).
W76-06701

SEASONAL VARIATION OF ALGAL BIOMASS PRODUCTION POTENTIAL AND NUTRIENT LIMITATION IN YAQUINA BAY, OREGON,

Pacific Northwest Environmental Research Laboratory, Corvallis, Oreg. Eutrophication and Lake Restoration Branch.
D. T. Specht.
In: 'Biostimulation and Nutrient Assessment,' (PRWG168-1), workshop proceedings September 10-12, 1975, Logan, Utah, Water Research Laboratory, Utah State Univ., Logan, November 1975, p. 149-174. 4 fig., 16 tab., 23 ref.

Descriptors: *Bioassay, *Eutrophication, *Estuaries, *Seasonal, Algae, Laboratory tests, Oregon, Biomass, Sea water, Growth rates, Toxicity, Hydrologic aspects, Precipitation (Atmospheric), Phosphorus, Nitrogen, Sewage effluents, Pollutants.
Identifiers: *Algal Assay Procedure, *Algal growth potential, Yaquina Bay (Ore.), *Dunaliella tertiolecta*, *Thalassiosira pseudonana*, *Selenastrum capricornutum*.

Characteristics of Yaquina estuary that change its potential nutrient limitation were studied using *Dunaliella tertiolecta*, *Thalassiosira pseudonana*, and *Selenastrum capricornutum* as test organisms. Although euryhaline in nature, *Dunaliella* and *Thalassiosira* did not produce substantial growth in some water samples. *Selenastrum* studies showed that the waters were not algal or algal-static because of a toxic substance, but lacked the salinity necessary for effective growth. *Selenastrum* could be used for qualitative bioassay of estuarine waters with salinities up to 6‰ but not above 9‰. *Dunaliella* responded reliably to addition of limiting nutrients at salinities as low as 5‰. The potential nutrient limitation and biomass potential in the Yaquina estuary changed with hydrological and precipitation changes associated with seasonal cycles. The estuary showed maximum sensitivity to addition of nutritive wastes in late spring and summer months when light and temperature potentials were highest, permitting maximum use of nutrients by algae. Bioassays showed that addition of either phosphorus or nitrogen or both could stimulate algal growth depending on point of introduction, season, or time of day. Removal of both phosphorus and nitrogen from sewage effluents or other pollutant sources before disposal into estuaries or their tributaries should be seriously considered. (See also W76-06696) (Buchanan-Davidson--Wisconsin).
W76-06702

ALGAL NUTRITIONAL BIOASSAYS OF LAKE WYLIE, NORTH CAROLINA.

Nalco Environmental Sciences, Northbrook, Ill. R. M. Gerhold.
In: 'Biostimulation and Nutrient Assessment,' (PRWG168-1), workshop proceedings September 10-12, 1975, Logan, Utah, Water Research Laboratory, Utah State Univ., Logan, November 1975, p. 175-220. 10 fig., 20 tab., 26 ref.

Descriptors: *Eutrophication, *Algae, *Bioassay, *Nutrients, North Carolina, Impoundments, Growth rates, Heated water, Phosphorus, Iron, On-site tests, Laboratory tests, Cyanophyta, Hydrogen ion concentration, Hydrologic aspects, Limiting factors, Chemical properties, Alkalinity, Nitrogen, Biomass.
Identifiers: *Algal growth potential, *Lake Wylie (N.C.), *Microcystis aeruginosa*, *Oscillatoria curviceps*, *Anabaena flos-aquae*.

Water samples from Lake Wylie were studied to understand nutrient relationships related to cultural eutrophication, seasonal changes in algal growth potential, limiting nutrients, biological availability of limiting nutrients, water quality characteristics important in controlling aquatic biota, and as a baseline for detecting significant changes. Samples were generally phosphorus-limited. Iron was occasionally critical. Doubling of the mean annual available phosphorus concentration would be necessary before another nutrient could become limiting. The Allen Steam Station did not affect the ability of Lake Wylie to support algal growth as a function of nutrient content. No urbanization effects were observed. Laboratory experiments and field observations supported the hypothesis that these waters were not conducive to excessive *Microcystis aeruginosa* growth and indicated that water with a low pH had a negative influence on algal growth. *Oscillatoria curviceps* was the dominant blue-green alga found. Blue-green algae were an insignificant portion of the total periphyton population at locations not under

the influence of the Allen Station hot water discharge. Seasonal influences were important in favoring blue-green algae. Water quality factors (pH, nutrient loadings, organic matter, dissolved oxygen, temperature) would have to change drastically before *Oscillatoria* or *Microcystis* could pose a threat to Lake Wylie. (See also W76-06696) (Buchanan-Davidson—Wisconsin). W76-06703

NUTRIENT ASSESSMENTS AS A BASIS FOR LAKE MANAGEMENT PRIORITIES, Wisconsin Univ., Madison. Water Resources Center.

P. D. Uttormark, and J. P. Wall. In: 'Biostimulation and Nutrient Assessment,' (PRWG168-1), workshop proceedings September 10-12, 1975, Logan, Utah, Water Research Laboratory, Utah State Univ., Logan, November 1975, p. 221-240. 8 fig., 5 tab., 14 ref. R-801363.

Descriptors: *Eutrophication, *Lakes, *Management, *Trophic level, Wisconsin, Classification, Phosphorus, Runoff, Decision making, Dissolved oxygen, Fishkill, Water quality, Drainage area, Turbidity. Identifiers: Phosphorus loading rate, Lake Condition Index.

A method of assessing management choices based on a lake classification index and phosphorus-loading estimates is presented. Assuming that a trophic condition is a continuous function of phosphorus-loading rates and restricting data to a small geographical area, a relationship between loading rate and lake condition can be demonstrated. By combining this knowledge with lake numbers, sizes, and proximity to population centers, management priorities can be established. A lake condition index based on hypolimnetic dissolved oxygen, transparency, fishkills, and use impairment was developed and applied to Wisconsin lakes. Indices were consistent with lake type and comparable to water quality characteristics, so can be used to quantify Wisconsin lake conditions. A plot of estimated phosphorus-loading versus lake condition index for Wisconsin lakes was used to indicate management categories. The ratio of drainage basin area to lake area was plotted against the lake condition index. A plot of relative phosphorus-loading versus lake condition index appeared to follow the expected trend. Although this approach indicated alternatives and priorities for lake water quality management, questions remain about whether it provides a perspective of actual field conditions or whether the parameters need refinement before results can be useful for management options. (See also W76-06696) (Buchanan-Davidson—Wisconsin). W76-06704

COMPARISON OF SEMI-CONTINUOUS AND CONTINUOUS FLOW BIOASSAYS, Utah State Univ., Logan. Div. of Environmental Engineering.

J. H. Reynolds, E. J. Middlebrooks, D. B. Porcella, and W. J. Grenney. In: 'Biostimulation and Nutrient Assessment,' (PRWG168-1), workshop proceedings September 10-12, 1975, Logan, Utah, Water Research Laboratory, Utah State Univ., Logan, November 1975, p. 241-265. 12 fig., 7 tab., 17 ref.

Descriptors: *Bioassay, *Laboratory tests, *Cultures, Toxicity, Chlorophyta, Algae, Growth rates, Mathematical models, Temperature, Phenols, Competition, Inhibition. Identifiers: *Selenastrum capricornutum.

In semi-continuous flow cultures the organism specific growth rate, substrate concentration, and cell concentration vary, while in continuous flow cultures there is a steady state where organism specific growth rate, substrate concentration, and cell concentration are theoretically constant. If the withdrawal period in semi-continuous flow cul-

tures is small enough, continuous flow cultures will be approximated. Actually continuous flow cultures may be considered as a special case of semi-continuous cultures where number of withdrawals per unit time in infinity. The critical factor is the time between withdrawal of culture content and addition of fresh substrate. An experiment was conducted to develop a mathematical model to predict temperature effects on phenol toxicity to *Selenastrum capricornutum* and to compare semi-continuous and continuous flow cultures. Both methods showed that phenol was more toxic at 24°C than at 20°C or 28°C, but the level of toxicity indicated by continuous flow competitive inhibition constants was greater than that indicated by the semi-continuous flow constants. Continuous flow data showed that phenol was more toxic as the hydraulic residence time increased. These differences may be due to variation in the organism specific growth rate which is observed in semi-continuous cultures and may mask certain toxic effects. (See also W76-06696) (Buchanan-Davidson—Wisconsin). W76-06705

THE EFFECTS OF MEDIA MODIFICATIONS UPON SELENASTRUM CAPRICORNUTUM IN BATCH CULTURES, Utah Water Research Lab., Logan.

R. F. Malone, K. A. Voos, W. J. Grenney, and J. H. Reynolds. In: 'Biostimulation and Nutrient Assessment,' (PRWG168-1), workshop proceedings September 10-12, 1975, Logan, Utah, Water Research Laboratory, Utah State Univ., Logan, November 1975, p. 267-292. 22 fig., 3 tab., 10 ref.

Descriptors: *Cultures, *Algae, *Growth rates, Chlorophyta, Mathematical models, Nitrogen, Laboratory test, Essential nutrients, Toxicity, Inhibition, Carbon, Bicarbonates, Phosphates, Hydrogen ion concentration. Identifiers: *Culture media, *Algal growth potential, *Selenastrum capricornutum*, Algal Assay Procedure.

In order to develop a mathematical model which accurately predicts the growth of *Selenastrum capricornutum* under nitrogen limited conditions, an algal growth simulation program was developed permitting simulation of algal growth in batch, semi-continuous, and continuous cultures. When a 0.03 M sodium or potassium phosphate buffer system was used with modified PAAP or NAAM media, a significant reduction in algal growth occurred. This inhibition caused an essential nutrient to be removed, and there may also be a toxicity effect due to the high total dissolved solids level. Addition of 1.512 mg/l sodium bicarbonate to the modified PAAP medium was enough to fulfill the carbon supplementation needs of un-aerated cultures, but higher levels of sodium bicarbonate caused minor to severe inhibition of growth. In un-buffered cultures utilizing sodium bicarbonate for carbon supplementation, growth seemed to be limited by pH; use of a buffer with this medium could increase growth. Nitrogen limitation was not significant until nitrogen levels in the modified PAAP medium were reduced to below 0.6 of the unmodified concentration. At 0.2 and 0.4 nitrogen levels, cultures were limited by some factor other than nitrogen until the algal density reached a high level. (See also W76-06696) (Buchanan-Davidson—Wisconsin). W76-06706

SEDIMENT-WATER MICROCOSMS FOR ASSESSMENT OF NUTRIENT INTERACTIONS IN AQUATIC ECOSYSTEMS, Utah Water Research Lab., Logan.

D. B. Porcella, V. D. Adams, and P. A. Cowan. In: 'Biostimulation and Nutrient Assessment,' (PRWG168-1), workshop proceedings September 10-12, 1975, Logan, Utah, Water Research Laboratory, Utah State Univ., Logan, November 1975, p. 293-322. 7 fig., 7 tab., 38 ref. OWRT B-081-UTAH (3).

Descriptors: *Limnology, *Laboratory tests, *Design, *Ecosystems, Chemical reactions, Balance of nature, Nitrogen, Carbon dioxide, Oxygen, Methane, Hydrogen sulfide, Photosynthesis, Sediment-water interfaces, Anaerobic conditions, Analytical techniques, Gases, Nitrogen fixation, Nitrification, Denitrification, Hydrogen ion concentration, Dynamics, Iron, Phosphorus.

Microcosms designed to observe sediment-water interactions of chemical balances of important elements and to perform bioassays in microbially-dominated sediment-water systems are described. Nitrogen, carbon dioxide, oxygen, methane, ethylene, and hydrogen sulfide were detected. In the dark oxygen was used rapidly, thus oxygen was low in the water and atmosphere while the sediment was anaerobic. Atmospheric nitrogen dynamics were not appreciably affected by nitrogen fixation. Oxygen dynamics were responsive to benthic oxygen demands in dark microcosms; in the light photosynthesis released oxygen into the atmosphere. Carbon dioxide dynamics caused a pH of 6.5-7.0 in the dark and 9.5-10.0 in the light. Methane was produced in all microcosm sediments after 40 days and ethylene after 120 days. Dissolved oxygen dynamics in lighted microcosms showed that almost all carbon dioxide was used. Sediment nitrogen output was small but input was appreciable, especially in upper layers. Nitrogen fixation only occurred in lighted microcosms indicating fixation by blue-green algae. In lighted microcosms nitrogen fixation was enough to fill nitrogen requirements but another nutrient was limiting growth. Denitrification occurred in the plus nitrogen dark microcosms; nitrification was not observed. Organic iron and iron-phosphorus interactions controlled iron and phosphorus availability; these elements were supplied by sediments in excess of photosynthetic needs. (See also W76-06696) (Buchanan-Davidson—Wisconsin). W76-06707

EFFECTS OF WATER HARDNESS, PHOSPHORUS CONCENTRATION AND SAMPLE PRETREATMENT ON THE ALGAL ASSAY PROCEDURE—BOTTLE TEST, FMC Corp., Princeton, N.J. Environmental Research Labs.

J. F. Jadlocki. In: 'Biostimulation and Nutrient Assessment,' (PRWG168-1), workshop proceedings September 10-12, 1975, Logan, Utah, Water Research Laboratory, Utah State Univ., Logan, November 1975, p. 323-333. 7 tab., 4 ref.

Descriptors: *Bioassay, *Cultures, *Hardness (Water), *Phosphorus, Growth rates, Chlorophyta, New York, Indiana, Calcium carbonate, Sampling, Water treatment, Fluorescence, Chemical analysis, Standing crops, Precipitation (Chemical), Chlorophyll, Eutrophication. Identifiers: *Algal assay procedure, *Selenastrum capricornutum.

To determine if different types of pretreatment affect the results of the algal assay procedure-bottle test, chemical and algal assays were made on samples from lakes in New York and Indiana. Algal assays using *Selenastrum capricornutum* were done on water samples before treatment or after pretreatment by autoclaving and/or filtration. The results indicated that pretreatment of the water samples may cause erroneous results in the algal assay procedure-bottle test. The controlling factors include water hardness, phosphorus concentration, and standing algal crops. Waters which are very hard (above 200 ppm as calcium carbonate) and have a high orthophosphate concentration (above 10 micrograms/l) may form a precipitate during autoclaving which effectively depletes the available phosphorus, especially if the precipitate is removed by filtration. A substantial growth of algae (over 200 fluorescence units from *in vivo* chlorophyll-a) in these waters would release enough dissolved phosphorus during autoclaving to

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cause a net increase in soluble phosphorus concentration. Much of the increased analyzable orthophosphate was apparently not available for *Selenastrum* growth, since the expected growth corresponding to the increased orthophosphate analyses was not observed. Filtration pretreatment may also remove large amounts of total phosphorus from eutrophic water samples. (See also W76-06696) (Buchanan-Davidson-Wisconsin)
W76-06708

A BIOASSAY DILUTION TECHNIQUE TO ASSESS THE SIGNIFICANCE OF DREDGED MATERIAL DISPOSAL,
Army Engineer Waterways Experiment Station, Vicksburg, Miss.
R. H. Plumb.

In: "Biostimulation and Nutrient Assessment," (PRWG168-1), workshop proceedings September 10-12, 1975, Logan, Utah, Water Research Laboratory, Utah State Univ., Logan, November 1975, p. 335-346. 2 fig., 3 tab., 10 ref.

Descriptors: *Analytical techniques, *Bioassay, *Dredging, *Sediments, Nitrogen, Phosphorus, Algae, Growth rates, Nutrients, Cultures, Diffusion, Alabama.

Identifiers: *Algal growth potential, *Dunaliella tertiolecta*, *Selenastrum capricornutum*, Mobile Harbor (Ala), Algal assay procedure, Elutriate test.

A potential problem at open-water dredged material disposal sites is that nutrients (nitrogen and phosphorus) associated with dredged sediment and interstitial water may stimulate algal growth. Conventional bioassays are not applicable, since they only provide information on nutrient bioavailability in dredged material, not the significance of discharge, as conventional bioassays are run for long periods compared to the duration of dredged material perturbation. A bioassay is proposed, based on nonlinear diffusion data observed in the field, approximating changing concentration-time relationships at disposal sites. Elutriates were prepared by shaking sediment with site water, then allowing it to settle. After centrifugation and filtration, samples were inoculated with *Dunaliella tertiolecta* or *Selenastrum capricornutum*. At times selected by analysis of dye diffusion data, cultures were diluted to approximate what may happen at the disposal sites. Results with *Dunaliella* suggested that open-water disposal of Mobile Harbor (Alabama) sediments would have no significant effect on algal population; concentrated elutriates were toxic to *Dunaliella*. It is concluded that inhibitory and stimulatory additions would not significantly affect algae when dilution rates at open-water sites are considered. The method could provide information to help determine the appropriate method of dredged material disposal. (See also W76-06696) (Buchanan-Davidson-Wisconsin)
W76-06709

APPLICATIONS OF AEROSPACE TECHNOLOGY IN THE PUBLIC INTEREST: POLLUTION MEASUREMENT,

Denver Research Inst., Colo.
C. F. Heins, and F. D. Johnson.

Available from the National Technical Information Service, Springfield, Va 22161, as N74-19234, \$4.50 in paper copy, \$2.25 in microfiche. Report February 1974. 64 p. 7 fig., 4 tab., 34 ref. NASW-2362.

Descriptors: *Research and development, *Technology, *Remote sensing, Measurement, Pollution abatement, Monitoring, Water pollution, Weather forecasting, Equipment, Satellites (Artificial), Instrumentation, Data collections. Identifiers: *National Aeronautics and Space Admin.

The contributions of the National Aeronautics and Space Administration to the techniques of pollution

analysis and measurement are detailed. Three examples of air pollution monitors include the spectroscopic Dual Isotope Fluorescence Carbon Monoxide Monitor, the Dispersive Infrared Vehicle Exhaust Analyzer, and the Microwave Formaldehyde Analyzer. NASA's satellite sensing program utilizes the Vertical Temperature Profile Radiometer which can obtain temperature data under partly cloudy conditions. ERTS-1 monitors pollutants in coastal waters and lakes, and air pollutants by interferometry. It is conducting research aimed at achieving pollutant measurement, on a global basis, of long-lived gases, such as carbon monoxide, and their sources and sinks. Their satellite Nimbus G (Nimbus 6) will have the primary objective of detecting, identifying, mapping, and measuring air and ocean pollution to establish baseline levels. NASA-generated technology transfers for pollution measurement and control include methods to estimate carbon monoxide exposure, a correlation spectrometer for air pollution remote sensing, heat pipe applications for heat transfer, analytic techniques for organic water pollutants; telemetry systems for remote monitoring; environmental models and analysis, weather satellite data for air pollution control, computer programs to analyze combustion, a fuel vaporization model, a coal desulfurization process, and has increased the quality of antipollution equipment in offshore petroleum operations. (Auen-Wisconsin)
W76-06710

DIFFERENCES IN CHEMICAL COMPOSITION BETWEEN TWO SPECIES OF DAPHNIA AND SOME FRESHWATER ALGAE CULTURED IN THE LABORATORY,

Pittsburgh Univ., Pa. Dept. of Biology.
U. M. Cowgill, and C. W. Burns.
Limnology and Oceanography, Vol. 20, No. 6, p. 1005-1011, 1975. 3 fig., 3 tab., 10 ref.

Descriptors: *Absorption, *Chemicals, *Plankton, *Daphnia*, Algae, Chemical analysis, Heavy metals, Connecticut.
Identifiers: *Daphnia pulex*, *Daphnia magna*, *Euglena gracilis*, New Haven (Conn.).

Water from West Spring in New Haven, Connecticut, containing 53 elements, was used to culture *Daphnia magna* and *D. pulex* and algae. Fifty-four elements were detected in the plankton. The *Daphnia* were fed with a monoculture of *Euglena gracilis* supplemented occasionally with mixed cultures containing *E. gracilis* and varying proportions of Chlorophyceae. A comparison of the mean concentration (dry weight basis) of the *Daphnia* species and the two algal cultures showed the *Daphnia* concentration factor of 17.5 for chlorine, 6.9 for calcium, and 4.5 for sodium over that of the algae which it consumed. Concentration factors of the order of two were shown by *Daphnia* for scandium, neodymium, lanthanum, zirconium, bromine, and nickel over those of the algae. The algae accumulated greater concentrations of molybdenum, iron, magnesium, tin, silver, titanium, beryllium, copper, zinc, iodine, manganese, phosphorus, aluminum, arsenic, cobalt, potassium, lead, mercury, and silica, and contained about the same concentrations of cadmium as *Daphnia*. The chlorine concentration in the algae was quite small, suggesting that they exclude it from their cells. The algae concentrated the elements in the order of thousands, and in some cases greater. The mercury concentration in the plankton was unexpectedly high but the source of the mercury was undetermined. (Auen-Wisconsin)
W76-06713

ACCUMULATION RATE AND TURNOVER TIME OF ORGANIC CARBON IN A SALT MARSH SEDIMENT,
North Carolina State Univ., Raleigh. Dept. of Zoology.
L. M. Cammen.

Limnology and Oceanography, Vol. 20, No. 6, p. 1012-1015, 1975. 2 fig., 7 ref. DACW-72-73-C-0025, NOAA 04-3-158-40.

Descriptors: *Cycling nutrients, *Carbon, *Sediments, *Tidal marshes, North Carolina. Identifiers: *Carbon accumulation, Core Banks (N.C.), Drum Inlet (N.C.), Nutrient sources.

The rate of organic carbon production and the turnover time in Core Banks, a tidal salt marsh near Drum Inlet, North Carolina, were measured in natural sediments, bare spoil, spoil planted with *Spartina alterniflora*, and planted spoil fertilized with N and P. The concentration of organic carbon from low intertidal areas showed a logarithmic decrease with depth. Organic carbon (g sp m) incorporated in the top 13 cm of the low intertidal bare spoil was 107.0, 116.0 for planted spoil, and 129.1 for fertilized spoil. The net rate of accumulation of organic carbon (g sq m/yr) was 80.3 in the bare spoil, 87.0 in the planted spoil, and 96.8 in the fertilized spoil. The turnover time was estimated to be 3.7 to 4.5 years. It appeared that the main source of organic carbon was not growth and decomposition of *Spartina* but more likely a combination of detrital matter carried in by tidal action and benthic algae. The unvegetated plot had accumulated almost as much carbon as the plots with abundant *Spartina*. Inasmuch as benthic algal production in North Carolina probably is between 79 to 99 g C sq m/yr, the benthic algae alone could have accounted for virtually all of the accumulated carbon. (Auen-Wisconsin)
W76-06714

DEVELOPMENT OF OXYGEN DEFICITS IN 14 SOUTHERN ONTARIO LAKES,
Trent Univ., Peterborough (Ontario). Dept. of Biology.

D. C. Lasenby.
Limnology and Oceanography, Vol. 20, No. 6, p. 993-999, 1975. 1 fig., 3 tab., 24 ref.

Descriptors: *Oxygen sag, *Hypolimnion, *Measurement, *Trophic level, Canada, Standing crop, Seston, Opacity, Lake sediments. Identifiers: Ontario.

The usefulness of the hypolimnetic oxygen deficit as an indirect measure of standing crop was investigated in 14 southern Ontario lakes by comparing the deficit with a summer average for dry weight of seston and with Secchi depth in order to determine the importance of the choice of the upper limit of the hypolimnion in calculating the oxygen deficit and to test the linearity of its development. In 13 of the 14 lakes, the hypolimnetic areal oxygen deficit increased as the upper limit of the hypolimnion of that lake was chosen at successively deeper levels. With the exception of one lake, the decrease was linear. Areal hypolimnetic oxygen deficits ranged from 0.006 to 0.41 mg sq cm/day and did not correlate with average dry weights of seston (an indication that they may not be related), but were negatively correlated with Secchi depth; the effect of this decrease on the calculated deficit suggest that real and possible causative relationships exist between the transparency of the water in the epilimnion and rates of oxygen depletion in the hypolimnion. (Auen-Wisconsin)
W76-06715

THE ACID-BUBBLING METHOD FOR PRIMARY PRODUCTIVITY MEASUREMENTS MODIFIED AND TESTED,
Iceland Univ., Reykjavik. Science Inst.
For primary bibliographic entry see Field 5A.
W76-06716

PHOSPHORUS SOURCES FOR THE LOWER MADISON LAKES,
Wisconsin Univ., Madison. Water Chemistry Lab.
For primary bibliographic entry see Field 5B.
W76-06718

THE EFFECTS OF A BENTHIC GRAZER ON THE PRIMARY PRODUCTIVITY OF THE LITTORAL ZONE OF LAKE TAHOE.

California Univ., Davis. Div. of Environmental Studies.

R. W. Flint, and C. R. Goldman. *Limnology and Oceanography*, Vol. 20, No. 6, p. 935-944, 1975. 7 fig., 2 tab., 21 ref. NSF RANN GI-22.

Descriptors: *Primary productivity, *Crayfish, *Grazing, *Littoral, Aquatic plants, Periphyton, Hypolimnion, Invertebrates, California, Nevada, Cycling nutrients, Oligotrophy, California.
Identifiers: *Lake Tahoe(Calif), *Pacifastacus leniusculus*.

The crayfish, *Pacifastacus leniusculus*, because of its dominant biomass in the littoral zone occupies a unique trophic position in Lake Tahoe. Submerged macrophytes above 50 m are scarce as are animal food materials during much of the year, thus the crayfish population relies substantially on the littoral benthic periphyton for its food. This investigation was designed to establish what effect the crayfish has on the littoral zone periphyton production and to assess the effects of its grazing on aquatic macrophytes and its role in the recycling of nutrients. The nutrient contribution by crayfish excretion serves as an important source of ammonia which is converted to nitrate by heterotrophic activity and becomes directly available to periphyton. The importance of these nutrients to the benthic community was shown by the absence of any abnormal increase in nutrient levels in the water column and the lack of any overall increase in nitrogen in the lake indicated rapid recycling of this nutrient. The relationship between the crayfish and the benthic flora portrays a dynamic balance between primary and secondary production in this extremely oligotrophic environment. The crayfish represents an effective "cleanser" of the littoral area and provides a stable food source for the lake trout. (Auen-Wisconsin)
W76-06719

ACTIVITY COEFFICIENTS OF BICARBONATES AND CARBONATES IN SEAWATER.

Oregon State Univ., Corvallis. School of Oceanography.
R. M. Pytkowicz. *Limnology and Oceanography*, Vol. 20, No. 6, p. 971-975, 1975. 5 tab., 21 ref. NR083-102, NSF DES-7201631, ONR N00014-67-A-0369-0007.

Descriptors: *Analytical techniques, *Carbonates, *Bicarbonates, *Sea water, Measurement, Estimating equations.
Identifiers: Activity coefficients.

Data on single ion and mean activity coefficients are of use in physicochemical studies such as the interpretation of the solubility behavior of minerals in seawater. Mathematical equations are designed which allow the determination of the total (stoichiometric) activity coefficients of bicarbonate and carbonate ions in seawater as a function of the salinity from ratios of the thermodynamic and apparent dissociation constants of carbonic acid. This method makes it unnecessary to resort to ion-pairing models and thus avoids many assumptions. The first comprehensive mean activity coefficients of bicarbonate and carbonate salts taken from various sources are compiled; however their accuracy is unknown because of the mean-salt method assumptions and because the accuracies of the various components used in determination of the single-ion activity coefficients of bicarbonate and carbonate have not been established. They should, therefore, be compared to values obtained by independent means for bicarbonates as shown in the text. The single-ion activity coefficients of bicarbonate and carbonate presented as a function of salinity should be of use to geochemists who seek fast calculations of the distribution of carbon dioxide species in sedi-

ments. However, the values are only valid for pore waters with roughly the same relative composition as seawater. (Auen-Wisconsin)
W76-06720

APPARATUS FOR THE IN SITU CONCENTRATION OF TRACE METALS FROM SEAWATER.

Environmental Research Lab., Narragansett, R.I. For primary bibliographic entry see Field 5A.
W76-06721

SIMILARITIES BETWEEN THE UPTAKE OF NUTRIENTS AND INGESTION OF PREY.

M. Parker. *Verhandlungen Internationale Vereinigung Limnologie*, Vol. 19, Part I, p. 56-59, 1975. 6 ref.

Descriptors: *Productivity, *Digestion, *Absorption, *Predation, Mathematical models, Feeding rates, Equations.

The theorem is advanced that there may be a widespread unity in the process by which all organisms ingest food supported by the views that (1) both mouths and uptake sites are recycling entities performing similar functions; (2) that the Michaelis-Menton equation and Holling's (1965, 1966) equation, respectively, describe nutrient uptake by algae, etc., and ingestion by animals; (3) derive the Michaelis-Menton equation for animals possessing mouths; and (4) that the derived equation is similar to that of Holling. An equation depicts the ingestion process in a manner similar to an enzymatically catalyzed reaction, identifying the respective rate constants for obtaining, rejecting, and swallowing food, which generates equations expressing the rate of change in ingested food, food being processed, and food in the environment. If a steady state for mouths processing food is reached on a time scale short relative to changes in available and ingested food, and if mouths and food move randomly through the environment, and equation can be derived for the ingestion rate of one type of food. The generalizations are that: there are upper limits imposed on ingestion rates by the constraints of time, the law of nonsuperposition, and the fact that organisms and stomachs are finite in size; and that all ingestion is similar because of the recycling nature of both mouths and uptake sites. (Auen-Wisconsin)
W76-06723

A PISTON CORER FOR PEAT.

Woods Hole Oceanographic Institution, Mass. For primary bibliographic entry see Field 5A.
W76-06724

IDENTIFICATION AND MANAGEMENT OF EURASIAN WATER MILFOIL IN WISCONSIN.

Wisconsin Univ. Extension, Madison. Environmental Resources Unit.
S. A. Nichols. *Wisconsin Academy of Sciences, Arts and Letters*, Vol. 63, p. 116-128, 1975. 4 fig., 1 tab., 25 ref.

Descriptors: *Aquatic weed control, *Plant morphology, Life cycles, Habitats, Reproduction, Harvesting, Wisconsin, Drawdown, Dredging, Light penetration, Mechanical control, Manual control.
Identifiers: *Eurasian milfoil, *Myriophyllum spicatum L., *Identification, Shading.

The identification of Eurasian milfoil (*Myriophyllum spicatum* L.) to differentiate it from the native Wisconsin variety (*M. spicatum* var. *exalbescent* (Fernald) Jepson) is a prerequisite in a weed eradication program as only the invading species restricts usage of lakes. A review of the morphological differences between the two types indicates that the Eurasian variety characteristically has 14 or more pairs of leaflets per leaf while the native variety ordinarily has less than 14 pairs of leaflets. The Eurasian variety has a

wide ecological amplitude and its distribution is primarily governed by substratum particle size, water depth, and water temperature. It has an affinity for alkaline waters and can utilize bicarbonate for photosynthesis. Its growth and reproduction is described. Repeated mechanical harvesting is effective in controlling milfoil; cleaning small problem areas with a rake is also beneficial. Habitat manipulation such as drawdown, dredging, and sand blanketing are also effective. Spot control of native milfoil was achieved by shading the surface of a farm pond with plastic sheeting. Recent research has indicated that milfoil has about the same protein content as alfalfa hay; also it has a high xanthophyll content, which may eventually make the species commercially valuable. (Auen-Wisconsin)
W76-06725

INFLUENCE OF WATERLOGGING ON MICROBIAL MINERAL WEATHERING. (IN FRENCH).

Centre National de la Recherche Scientifique, Vandoeuvre-les-Nancy (France). Centre de Pedologie Biologique.
J. Berthelin, and A. Kogblevi. *Rev Ecol Biol Sol* 11(4); p 499-510, 1974.

Descriptors: *Microbiology, *Weathering, *Soils, Anaerobic conditions, Bacteria, Iron, Calcium, Magnesium, Manganese, Solubility, *Saturated soils.

A semi-continuous flow method was used for studying the influence of waterlogging on the microbial weathering of soil columns. One set of soil columns was waterlogged, the other normally drained. Sterile controls for both sets were made by addition of sodium merthiolate to the nutrient solution. The influence of waterlogging on net microbial solubilization process was depended on the chemical nature of the elements involved. It actively promoted the net microbial solubilization of Fe, Mn, and Ca at the beginning of the experiment. Net microbial solubilization of Si and Al decreased. Perfusion of 45 days resulted in leaching 129.5 mg of Fe₂O₃ from waterlogged non-sterile, 19.9 mg from normally drained, non sterile, 0.3 mg from waterlogged sterile, and 0.5 mg from normally drained sterile, columns. Corresponding weathering indices of Fe in waterlogged conditions was predominantly reductive process, since solubilized Fe was mostly ionic Fe and its production was correlated with very low Eh's (redox potentials) (-200 to -400mV). Waterlogging conditions decreased the aerobic microbial population, but it favored anaerobic bacteria and promoted the formation of organic volatile acids.--Copyright 1975, Biological Abstracts, Inc.
W76-06730

STUDY OF THE GENUS VIBRIO IN DRINKING WATER. (IN SPANISH).

Instituto Bacteriologico de Chile, Santiago.
J. H. Lobos, R. Greive, M. L. Quijada, and H. Brandt. *Bol Inst Bacteriol Chile* 16(1/2), p 40-42, 1974.

Descriptors: Potable water, Epidemiology, Human diseases, Cultures, Salmonella, Pathogenic bacteria, Public health, Water pollution effects.
Identifiers: Cholera, *Vibrio.

Periodic study of the *Vibrio* genus for the diagnosis of cholera in the countries where it does not now exist is advisable. Recent epidemiological conditions have caused areas that are usually free from this disease to become infected. The prevalence of some species of *Salmonella* or other predominant enteropathogenic species can be investigated at the same time. This simple study can be done even with some culture media prepared in the laboratory.--Copyright 1975, Biological Abstracts, Inc.
W76-06731

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Group 5C—Effects Of Pollution

STUDY OF THE STRONTIUM 90/STRONTIUM ISOTOPE BALANCE IN A LATVIAN LAKE, (IN RUSSIAN), Akademiya Nauk Latvskoi SSR, Riga. Inst. of Biology.
For primary bibliographic entry see Field 5A.
W76-06733

ON THE UNIVERSALITY OF THE POOLE AND ATKINS SECCHI DISK-LIGHT EXTINCTION EQUATION, Agricultural Research Service, Phoenix, Ariz. Water Conservation Lab.
For primary bibliographic entry see Field 5A.
W76-06737

PHOTOSYNTHETIC RATES OF PHYTOPLANKTON IN EAST AFRICAN ALKALINE, SALINE LAKES, Duke Univ., Durham, N. C. Dept. of Zoology. J. M. Melack, and P. Kilham.
Limnol Oceanogr. 19(5), p. 743-765, 1974.

Descriptors: *Photosynthesis, *Phytoplankton, Lakes, *Saline lakes, *Africa, Alkalinity, *Dissolved oxygen, Cyanophyta, Polarographic analysis.
Identifiers: Kenya, Tanzania.

Photosynthetic rates were calculated in 6 myxophyceae-dominated alkaline, saline lakes in Kenya and Tanzania from changes in dissolved O₂ in light and dark bottles and from diurnal variations in dissolved O₂. Rates of gross photosynthesis are exceptionally high for Lake Nakuru, Kenya, by the diurnal free-water technique (e.g., 36 g O₂ m⁻² day⁻¹). Gross photosynthesis in Lake Nakuru was compared for 2 consecutive days: on the 1st day pronounced thermal stratification developed and the dissolved O₂ reached 340% saturation in the upper half meter; on the 2nd day wind-driven turbulence circulated the algae to depths often greater than 2 m in water with Secchi disk visibility of only 15 cm. Because of analytical difficulties in measuring dissolved O₂ in soda lakes, laboratory experiments were conducted to determine the reliability of the titrimetric (Winkler, Miller), gasometric (Scholander) and polarographic (oxygen probe) methods. The polarographic technique was the most suitable for determinations of dissolved O₂ in the field. -- Copyright 1975, Biological Abstracts, Inc.
W76-06742

A TEMPERATURE-STRESSED STREAM ECOSYSTEM BELOW A HYPOLIMNIAL RELEASE MOUNTAIN RESERVOIR, Colorado State Univ., Fort Collins. Dept. of Zoology; and Colorado State Univ., Fort Collins. Dept. of Entomology. J. V. Ward.
Arch Hydrobiol. 74(2), p. 247-275, 1974.

Descriptors: *Hypolimnion, *Colorado, *Ecosystems, Invertebrates, Reservoirs, Seasonal, Streams, *Water temperature, *Standing crops.

Biological, chemical and physical parameters were measured over a 12-mo. period at 4 sampling sites on the South Platte River below a Colorado mountain reservoir. Owing to the hypolimnial source, the stream temperature was higher than normal in winter, lower in summer, fluctuated less diurnally and seasonally and exhibited a seasonally increased maximum. These effects decreased downstream, but still altered the temperature pattern 8.5 km below the dam. The number of species of macroinvertebrates progressively increased downstream, the temperature regime is probably responsible for the low diversity by failing to stimulate various developmental stages of the life cycle or by seasonally altering developmental patterns. The river below the dam is a temperature-stressed ecosystem, this is the major reason for

the low diversity and large standing crop of macroinvertebrates. --Copyright 1975, Biological Abstracts, Inc.
W76-06743

A STUDY OF THE BENTHIC MACRO-INVERTEBRATES OF A SHALLOW EUTROPHIC RESERVOIR IN SOUTH WALES WITH EMPHASIS ON THE CHIRONOMIDAE (DIPTERA); THEIR LIFE HISTORIES AND PRODUCTION, University of Wales Inst. of Science and Technology, Cardiff. Dept. of Applied Biology. D. W. B. Potter, and M. A. Learner.
Arch Hydrobiol. 74(2), p. 186-226, 1974.

Descriptors: Reservoirs, Lakes, *Eutrophication, *Invertebrates, *Diptera, Benthic fauna, *Life cycles, *Production, Water pollution effects.
Identifiers: Hirudinea, Isopoda, South Wales, Shallow reservoirs.

Production and life-history studies were carried out in 1970 and 1971 on the principal macro-invertebrate species and groups inhabiting the benthic deposits of a shallow eutrophic reservoir in South Wales (United Kingdom). The species studied belonged to the Chironomidae (11 spp.), Tubificidae (2 species-groups), Hirudinea (1 sp.), Isopoda (1 sp.). Total production was about 37 g dry weight/m²/yr, 43% of which was chironomid production. Comparison is made with production estimates obtained for other lakes in Europe. -- Copyright 1975, Biological Abstracts, Inc.
W76-06747

FLOODING AS THE RESULT OF HURRICANE AGNES, AND ITS EFFECT ON A MACROBENTHIC COMMUNITY IN AN INFERTILE HEADWATER STREAM IN CENTRAL PENNSYLVANIA, Pennsylvania Fish Commission, Bellefonte. Benner Spring Fisheries Research Station. L. Hoopes.
Limnol Oceanogr. 19(5), p. 853-857, 1974.

Descriptors: *Pennsylvania, *Benthos, Discharge(Water), *Peak discharge, *Floods, Streamflow.
Identifiers: *Hurricane Agnes(1972), Burns Run(Penn.).

Hurricane Agnes in June 1972 resulted in a 150-fold increase in the discharge of Burns Run, Pennsylvania (USA). A 22.7 m³ sec⁻¹ peak discharge severely depressed the benthic community which, however, recovered by Oct. 1972. -- Copyright 1975, Biological Abstracts, Inc.
W76-06748

THE BACTERIAL COMPOSITION, AND THE METABOLIC ACTIVITY OF SOME PHYSIOLOGICAL GROUPS OF BACTERIA IN TWO GRAVEL PIT LAKES, Slovenska Akademie Vied, Bratislava (Czechoslovakia). Limnologisches Institut. I. Daubner, and R. Ritter.
Arch Hydrobiol. 72(4), p. 440-459, 1973.

Descriptors: Lakes, Gravels, *Denitrification, *Metabolism, *Bacteria, Microbiology, *Nitrification, Water pollution effects.
Identifiers: *Ammonification, *Gravel pit lakes.

Complex microbiological analysis of the water in 2 gravel pits were conducted in parallel with laboratory experiments during the course of a yr. A correlation was noted between the numbers of physiological bacteria groups and their metabolic activity. Ammonification, nitrification and denitrification were investigated. --Copyright 1975, Biological Abstracts, Inc.
W76-06749

OWASCO LAKE AND ITS WATERSHED, A SUMMARY REPORT WITH TWO APPENDICES AND MAPS, Cornell University, Ithaca, N. Y. Dept. of Natural Resources.

R. T. Oglesby, L. S. Hamilton, E. Mills, and P. Willing.
Available from the National Technical Information Service, Springfield, Va 22161 as PB-251 939, \$7.75 in paper copy, \$2.25 in microfiche. Cornell University Water Resources and Marine Sciences Center, Technical Report No. 70, June 1973. 199 p, 2 append. OWRT B-030-NY(1), 14-01-0001-3832.

Descriptors: Water quality, *New York, Lakes, Watersheds(Basins), *Baseline studies, *Eutrophication, Water quality standards, Fish population, *Land use, Environmental effects, *Land development, Aesthetics, Mapping, Geomorphology, Slopes, Soils, Groundwater, Water pollution effects, Attitudes, Social values, Social change.
Identifiers: *Owasco Lake(NY), Environmental quality, Soil depth.

The following topics concerned directly with Owasco Lake and its tributaries, are considered: Establishment of a baseline description of water quality for comparison against any future changes that occur. Comparison of all water quality data collected since 1910 and that from the present study to see if any historical trends (particularly those that might indicate accelerated eutrophication of the lake) could be detected. A determination of the principal factors affecting water quality, with the exception of public health related parameters, for which County and State health authorities have clearly stated responsibilities. Some interactions between the Owasco Lake environment and the fish populations of the lake are described. The concept of limitations to land uses is presented as a means of maintaining environmental quality. Specific physiographic limiting factors such as slope, soil depth, flood susceptibility, and groundwater supplies are discussed and mapped on overlays. The constraints they offer to development are set forth. Aesthetic and cultured features which should not be damaged by incompatible development are identified and mapped on an overlay. A final composite of limiting features is presented as a planning guide to identify where on-site investigations may be needed to prevent loss of environmental quality when a change in land use is proposed. Management alternatives relating to land use in the Owasco basin are presented and discussed.
W76-06751

HYDROGRAPHICAL FEATURES OF NORD-BYTJERNET, A MANGANESE-RICH MEROMICTIC LAKE IN SE NORWAY, Oslo Univ. (Norway). Dept. of Limnology. D. Høngve.
Arch Hydrobiol. 72(4), p. 227-246, 1974.

Descriptors: Lakes, Europe, *Manganese, Hydrography, *Iron, Organic matter, Oxygen, Lake sediments, Water pollution effects.
Identifiers: Macrophytes, *Meromictic lakes, *Norway(Nordbytjernet), *Oxygen depletion.

Nordbytjernet is a meromictic lake where large concentrations of Fe and Mn have been found in the monimolimnion. The concentration of Mn is of an order of magnitude which is very remarkable in natural surface water. The special conditions depend upon large supplies of Fe and Mn which are continuously delivered by inflowing ground water. Large amounts of organic matter, mainly produced as macrophytes in the littoral, cause lack of O₂ and reduction of Fe and Mn in the hypolimnion. The sediments also possess abnormal contents of Fe and Mn, which, according to the solubility products, must be precipitated as FeCO₃ and MnCO₃. --Copyright 1975, Biological Abstracts, Inc.
W76-06752

EMPIRICAL FUNCTIONS RELATING METABOLIC PROCESSES IN AQUATIC SYSTEMS TO ENVIRONMENTAL VARIABLES, Washington State Univ., Pullman. Dept. of Zoology.

R. A. Parker.
J Fish Res Board Can. 31(9), p 1550-1552, 1974.

Descriptors: *Metabolism, *Light intensity, *Temperature, *Nutrients, Aquatic environment.

Two empirical relationships were proposed to describe the metabolic consequences of high and low levels of light intensity, temperature and nutrients in aquatic systems. Their performance was evaluated for 3 sets of data taken from the literature.—Copyright 1975, Biological Abstracts, Inc.
W76-06755

CONTROL OF SPECIES COMPOSITION IN ENRICHED MASS CULTURES OF NATURAL PHYTOPLANKTON POPULATIONS, Skidaway Inst. of Oceanography, Savannah, Ga. W. M. Dunstan, and K. R. Tenore.

J Appl Ecol. 11(2), p529-536, 1974.

Descriptors: *Phytoplankton, *Algae, Aquaculture, Cultures, Nutrients, Eutrophication, Nitrogen, Phosphorus, Seasonal, Sewage effluents, Diatoms, Chlorophyta.
Identifiers: *Cylindrotheca-Closterium*, *Silicon*, *Skeletonema-Costatum*, *Stephanopyxis-Costata*.

The changes in species composition of intensively harvested outdoor cultures of enriched natural populations of micro-algae were studied using a variety of nutrient additions and dilution rates. The control of species in such semi-continuous outdoor cultures is not only important for aquaculture systems but is also helpful in identifying the effects of eutrophication on coastal phytoplankton populations. In a series of 3 experiments in which cells were counted and identified during the 6th-10th day of the daily 50% harvest, N, P and Si definitely favored the growth of diatoms. The addition of just N and P or N, P and trace metals stimulated a green microalgae population. Addition of treated sewage effluent resulted in a 70-80% diatom culture. In another series of experiments the rate of daily dilution was varied and in 2 experiments in June a clear control of species composition resulted. In 10% daily dilution green micro-algae dominated while at 75% dilution diatoms dominated particularly *Skeletonema costatum* (now *Stephanopyxis costata*). The results from experiments in July and Aug. were not as definitive as those in June and the ubiquitous diatom *Cylindrotheca closterium* prevailed at all dilution rates.—Copyright 1975, Biological Abstracts, Inc.
W76-06757

OBSERVATIONS AND EXPERIMENTS ON THE PHYTOPLANKTON OF BLEHAM TARN, ENGLISH LAKE DISTRICT I. THE EXPERIMENTAL TUBES, T. J. Lack, and J. W. G. Lund.

Freshwater Biol. 4(4), p399-415, 1974.

Descriptors: *Phytoplankton, Limnology, Lakes, Seasonal, Tubes, Sampling, Algae, Europe.
Identifiers: *Melosira-Italica*-SSP-Subarctica.

Tubes composed on butyl rubber were placed in a small English lake in an area where the water is 11-12 m deep. Each tube, when fully distended, contained over 18,000 m³ of water. The tubes were anchored to the shore and lake bottom. A boat was rowed into them over a specially strengthened portion of the margin. The 1st was installed and its water isolated from that in the lake by the end of July 1970 and the 2nd tube at the beginning of Oct. 1970. The installation, maintenance and performance of the tubes are described; as are suggested improvements. The temperature regime in

the tubes closely follows that in the lake. If the chemical conditions are favorable, the seasonal cycle of *Melosira (italica ssp. subarctica)* in a tube is similar to that in the lake. Contamination of the water in the tubes by that in the lake is slight and has a negligible effect on chemical conditions within them. Water can be lost from the tubes under certain conditions. The reverse does not happen. The phytoplankton communities in the tubes are similar in quality to those of the lake, even after 2.5 yr of separation. The tubes are apparently suitable for investigations on certain factors determining the abundance and seasonal cycles of algae in lakes and for other limnological studies.—Copyright 1975, Biological Abstracts, Inc.
W76-06758

POLYSPECIES AQUACULTURE SYSTEMS: THE DETRITAL TROPHIC LEVEL, Woods Hole Oceanographic Institution, Mass. Dept. of Biology. K. R. Tenore, M. G. Browne, and E. J. Chesney.

J Mar Res. 32(3), p425-432, 1974.

Descriptors: *Aquaculture, *Oysters, *Trophic level, Detritus, Phytoplankton, Amphipoda, Cultures.
Identifiers: *Capitella-Capitata*, *Corophium-Sp*, *Nereis-Virens*, *Polychaetes.

The production of species belonging to the detrital trophic level was investigated in model-sized aquaculture system, with flowing, filtered seawater and controlled phytoplankton addition to experimental tanks containing the oyster, *Crassostrea virginica*. The biodeposits of feces and pseudofeces of the oysters supported on the bottom of 1 tank a population of the nereid polychaete, *Nereis virens* and in the other tank a mixed community of the capitellid polychaete, *Capitella capitata* and the amphipod, *Corophium sp*. The nereids showed a 2.8 fold increase in average weight of worm in 100 days and the *Capitella-Corophium* community reached a standing biomass of 24.4 grams carbon/m². The feasibility of successful culture of such species in polyculture systems is suggested. Polyculture both increases and diversifies the crop production and eliminates the build-up of detrital wastes characteristic of simple food chains in aquaculture.—Copyright 1975, Biological Abstracts, Inc.
W76-06759

LAKE ELLESMERE, CANTERBURY, NEW ZEALAND: A REVIEW OF THE LAKE AND ITS CATCHMENT, Department of Scientific and Industrial Research, Lower Hutt (New Zealand). Ecology Div. H. R. Hughes, R. H. S. McColl, and D. J. Rawlence.

N Z Dep Sci Ind Res Inf Ser. 99, p 1-27, 1974.

Descriptors: *Lakes, Eutrophication, Algae, Blue-Green algae, Canada goose, Fish, Swams, Trout, Weeds, Water pollution effects.
Identifiers: Lake Ellesmere(New Zealand).

Lake Ellesmere, New Zealand, and its agricultural catchment are described with special reference to the lake's biology and chemistry, and the interests of the management authority-the North Canterbury Catchment Board, farmers, commercial fishermen, sportsmen, and the general public. The lake, which is shallow and nutrient-rich, is periodically opened to the sea, allowing drainage and influx of sea water. Problems giving concern are eutrophication of the lake, the appearance of bluegreen algal blooms, the disappearance of aquatic weed beds supporting some of the water fowl, particularly black swan, the depredation of farmland by black swan and Canada geese (apparently as a result of reduced food supplies in the lake), the failure of the black swan to breed, deaths of commercial fish and difficulties in controlling lake

level. Problems in contributing drains and waterways are the control of water flow and quality, excessive aquatic weed growth and the provision of sufficient water for irrigation while maintaining the trout fishery. Recommendations are made of practical methods for minimizing the deterioration of Lake Ellesmere and for further research to facilitate improved management.—Copyright 1975, Biological Abstracts, Inc.
W76-06762

THE IMPORTANCE OF THE EFFECT OF THE CHEMICAL COMPOSITION OF WATER ON THE POPULATION OF SNAILS: INTERMEDIATE HOSTS OF SCHISTOSOMES IN EGYPT, Bilharziasis Research Inst., Cairo (Egypt). A. A. El-Hassan.

Folia Parasitol (Prague). 21(2), p 169-179, 1974.

Descriptors: *Snails, Gastropods, *Ions, Chemical properties, Population, Toxicity, Habitats, Distribution.
Identifiers: *Biomphalaria-Alexandrina*, *Bulinus-Truncatus*, Egypt, *Schistosomes*.

The effect of the chemical composition of water on the distribution of *Bulinus truncatus truncatus* and *Biomphalaria alexandrina alexandrina*, the 2 snail intermediate hosts of schistosomes, was studied. The lethal concentration of common ions present in fresh water for different stages of the snails was obtained. The least tolerant stages are newly hatched snails of both species. *Biomphalaria* snails are more tolerant than *Bulinus* snails to the examined ions. In the field, the concentration of various ions in water-bodies seldom reaches these lethal extremes. Some variations in the chemical composition of water were observed in habitats harboring each species. The restricted distribution of *Biomphalaria* snails in the Delta and its absence from Upper Egypt cannot be attributed to variations in the chemical constituents of water. Both the Delta and Upper Egypt contain water-bodies with microhabitats suitable for the establishment of both snail species. The chemical composition of water may indirectly influence the distribution of snail intermediate hosts by influencing the types and growth of microflora which is essential as food for the snails.—Copyright 1975, Biological Abstracts, Inc.
W76-06763

GENETIC DIFFERENCES IN SUSCEPTIBILITY TO TWO DISEASES AMONG STRAINS OF THE COMMON CARP, Agricultural Research Organization, Dor (Israel). Fish and Aquaculture Station. R. S. Hines, G. W. Wohlfarth, R. Moav, and G. Hulata.

Aquaculture. 3(2), p 187-197, 1974.

Descriptors: *Carp, *Fish diseases, Ponds, Fisheries, Fish management, Fish stocking.
Identifiers: *Aeromonas-Liquefaciens*, Israel, *Epidermal epithelioma.

In a test involving 5 inbred strains, and 9 strain crossbreds of the common carp, 1 inbred strain was infected by Epidermal epithelioma disease and a 2nd inbred strain was infected by a swim bladder inflammation. Crossbreds between these 2 strains, as well as between them and other strains did not show a single fish infected by either disease. Susceptibility to both of these diseases is probably controlled by recessive genetic factors. It appears that the decreased incidence of Epidermal epithelioma in Israeli fish ponds in recent years has been due to the increased use of selected crossbred carp fry. The incidence of Epidermal epithelioma was twice as high in experimental ponds with a high stocking rate than in those with a lower stocking rate. The swim bladder inflammation was apparently due to a blockage of the pneumatic duct, with secondary infection by *Aeromonas liquefaciens*.—Copyright 1975, Biological Abstracts, Inc.

Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

Group 5C—Effects Of Pollution

W76-06764

ASSOCIATIONS OF BLUE-GREEN ALGAE OF THERMAL SPRINGS OF STRAVROPOL AND KRASNODAR KRAIS AND GEORGIAN SSR, (IN RUSSIAN),
Leningrad State Univ. (USSR).
V. N. Nikitina.
Vestn Leningr Univ Biol 1, p 54-59, 1975.

Descriptors: Algae, *Cyanophyta, *Thermal springs, Reservoirs, Plankton, Aquatic algae.
Identifiers: Krai, Krasnodar, Stavropol, *USSR (Georgian SSR).

A detailed description is given of some of the mineral springs of the Caucasus (Russian SFSR and Georgian SSR, USSR). Blue-green algae predominate in the springs studied. A small number of plankton forms are determined by the type of reservoir. The springs are shallow basins with running water, small streams and boils. Benthic algae predominate and form thick and loose films, coatings and accumulations. The type of film formed is determined by the morphology of the algae. The forms with a mucous cover form thick leathery films. Loose coatings and accumulations consist of nonmucilaginous algae. Thick films are found in reservoirs with rapidly flowing waters. The forms with a mucous cover prefer rapid waters, while the forms without vaginiae prefer slow waters.—Copyright 1975, Biological Abstracts, Inc.

W76-06769

SEQUENCES OF EFFECTS OF A CITY SEWER: AS A FUNCTION OF THE REMOVAL OF THE SOURCE OF POLLUTION, ON THE PHOTO-PHILE POPULATIONS GROWING IN EXPOSED PLACES (ALGAL FRACTION); FIRST RESULTS, (IN FRENCH),
Aix-Marseille-2 Univ. (France). Laboratoire de Biologie Vegetale.
T. Belsher.
Bull Soc Phycol Fr 19, p 158-163, 1974.

Descriptors: *Sewers, Vegetation, Algae, Cities, Europe, Water pollution sources, Bays, Harbors, Water pollution effects.
Identifiers: *France (Marseilles), Photophile, Populations, Ulvaceae.

The algal vegetation of the upper part of the infralittoral, in a polluted region near Marseilles (France), was investigated using new methods of phytosociology. This vegetation is characterized by a small number of species, an unusually small Margalef's index, and by the extreme scarcity of Ulvaceae. Near the sewer of Cortiou, Protofloreidae form a dense cover on Corallina. This cover decreases westwards. Algal settlements growing in polluted areas are conspicuously different along open shores from those growing in sheltered bays and harbors.

W76-06770

CHLOROPHYLL A CONTENT AS AN INDEX OF PERIPHYTON PRODUCTIVITY, EXEMPLIFIED BY LAKE KRASNOE, (IN RUSSIAN),
For primary bibliographic entry see Field 5A.
W76-06772

WATER POLLUTION AND ANTHROPOGENIC EUTROPHICATION OF INLAND WATER BODIES, (IN RUSSIAN),
Akademiya Nauk SSSR, Moscow. Institut Geografii.
L. L. Rossolimo.
Gidrobiol Zh 11(1), p 5-11, 1975.

Descriptors: *Eutrophication, Water pollution, Algae, Inland waterways, Plankton.
Identifiers: *Anthropogenic disturbance.

The article deals with the difference between pollution and eutrophication, the validity of including anthropogenic disturbances into the notion eutrophication and with some other problems important in principle. (Planktonic algae are discussed.)

W76-06775

THE MICROFLORA OF AEROBIC BACTERIA IN GRAVEL PIT LAKES, (IN GERMAN),
Sueddeutsche Versuchs- und Forschungsanstalt fuer Milchwirtschaft, Weihenstephan (West Germany). Bakteriologisches Institut.
K. Thurner, and W. Haber.
Arch Hydrobiol 75(3), p 347-365, 1975.

Descriptors: *Aerobic bacteria, *Lakes, Gravel, *Eutrophication, Ecological distribution.
Identifiers: Achromobacteria, Coryneform, *Gravel pit lakes, Pseudomonad.

A collection of 3300 aerobic bacteria was isolated from gravel-pit lakes of different age and ecological state. The bacterial flora was different in the various ecosystems. Coryneforms, pseudomonads and achromobacteria, in almost equal numbers, seem to be typical of unpolluted groundwater lakes. In a distinctly eutrophic lake with a high total-count, coryneforms were found at a much higher rate. In a 2nd eutrophic lake characterized by different ecological conditions, the bacterial flora consisted mainly of gram-negative bacteria. In the latter case the pattern of bacterial groups among gram-negative rods was different from the distribution found in the other lakes. Further studies are necessary to establish the ecological significance of these results.—Copyright 1975, Biological Abstracts, Inc.

W76-06777

THE EFFECT OF BACTERIAL SUBSTANCES ON THE GROWTH OF TWO CLADOPHORACEAE IN PURE CULTURE, (IN GERMAN),
F. Schanz, and E. A. Thomas.
Vierteljahrsschr Naturforsch Ges Zur 119(2), p 165-198, 1974.

Descriptors: *Eutrophication, *Cladophora, Algae, Growth rates, Cultures, Europe, North America, Lakes.
Identifiers: Agar, Europe, *Rhizoclonium, *Switzerland (Lake of Zurich), Thiamine, *Wisconsin.

The increasing eutrophication of European and North American waters has led to highly increased Cladophoraceae growth. Increasing amounts of water bacterium (S2) raised on plate-count agar increased the yield of Rhizoclonium clone R2, Cladophora 4 from the lake of Zurich (Switzerland) and Cladophora from Lake Mendota, Wisconsin (USA) when added to their culture water. Increasing amounts of water which covered the plate-count agar induced a similar increase in growth due to the yeast extract and trypton transferred from the plate-count agar to the water. Five bacterial clones from the Lake of Zurich were cultivated on glucose-glutamate agar which does not give off substances which promote the growth of Rhizoclonium and these bacteria produced substances which did augment algal growth. Maximal growth increase occurred when 3x10⁻⁹ g thiamine was added to 100 ml of culture water. Thiamine also significantly improved the growth of both Cladophora clones. Since corresponding amounts occur in natural waters, the thiamine content of a body of water is significant in determining the occurrence and mass development of Rhizoclonium and Cladophora. This is probably true for all Cladophoraceae.—Copyright 1975, Biological Abstracts, Inc.

W76-06779

HORIZONTAL DISTRIBUTION OF ZOOPLANKTON IN THE MINGECHAUR RESERVOIR, (IN RUSSIAN),
For primary bibliographic entry see Field 2H.
W76-06780

CONTINUOUS CULTURES APPLIED TO ECOLOGICAL RESEARCH, (IN FRENCH),
Institut National de la Recherche Agronomique, Thonon-les-Bains (France). Station d'Hydrobiologie Lacustre.
J. Feuilleade, and M. Feuilleade.
Bull Soc Phycol Fr 19, p 94, 1974.

Descriptors: *Culture, Ecology, *Lakes, *Stratification, *Epilimnion, Nutrients, Plankton, Nitrogen, Phosphorus, Enzymes, Production.
Identifiers: Oscillatoria-Rubescens.

The epilimnion of a stratified lake can be compared with a culture functioning as a chemostat fed by 2 sources of nutritive elements: the affluent source and the hypolimnion. This method of continuous culture seems to be well adapted to ecological studies of lake plankton. Oscillatoria rubescens D.C., a frequent nuisance in eutrophic lakes, was studied. In the 1st experiment the N and P consumption of this species was studied. The rate of growth of the algae reaches equilibrium, a characteristic of the chemostat culture, when N or P reaches zero. Chemical and biological tests at this point show good correlation between N and P consumption and production of dry algal matter. The production of alkaline phosphatases depends on the P flow. The quantity of available P in the medium influences enzyme activity inversely. No relationship was found between phosphatase production and P extractable from the algae by boiling water.—Copyright 1975, Biological Abstracts, Inc.

W76-06782

STUDY OF THE PHOSPHATE METABOLISM OF A DRINKING WATER RESERVOIR, (IN GERMAN),
R. Hofmann.
Int Rev Gesamten Hydrobiol 60(1), p 63-95, 1975.

Descriptors: *Phosphates, *Metabolism, Potable water, Reservoirs, Water supply, *Primary production, Sediments, Europe.
Identifiers: Asterionella-Formosa, Fragilaria-Crotonensis, *East Germany (Saidenbach Reservoir).

A study was made of Saidenbach Reservoir, Erzgebirge, East Germany. The phosphate supply for the planktonic primary production comes almost exclusively from the inflows. The nutrient pool in the hypolimnion and in the sediment does not play a leading part. Evidently, that is often so in reservoirs. Both the phytoplankton (the most frequent species are Asterionella formosa and Fragilaria crotonensis) and the concentration of phosphate fractions are subject to considerable seasonal variations. The Asterionella spring maximum, typical of this reservoir, is released directly or indirectly by meteorological factors. An adequate orthophosphate concentration is a basic condition which is accomplished nearly every year. The autumnal Fragilaria maximum begins when a definite mixing depth has been achieved. The breakdown of diatom maximum is almost always caused by exhaustion of the phosphate reserves.

W76-06785

THE EFFECT OF WATER TEMPERATURE OF THE INCUBATION TIME OF A PITUITARY INJECTION IN CARP (CYPRINUS CARPIO L.) UNDER FIELD CONDITIONS, (IN GERMAN),
Frieburg Univ. (West Germany). Limnologisches Institut.
H. Kausch.
Arch Hydrobiol Supplement 47(3), p 413-422, 1975.

Descriptors: *Water temperature, *Carp, Thermal pollution, *Spawning, Ponds, Fish reproduction. Identifiers: Cyprinus-Carpio, Gonadotropin, Hormone-Drug.

The incubation time of pituitary injection for induced spawning of the common carp (*C. Carpio* L.) under pond culture temperature conditions during May and early June in southern Germany can be linearly related to ambient water temperature, using the equation $y = 46.78 - 1.403x$, where x = temperature in centigrades, and y = time in hours. Carp and bream pituitaries give equal effects. Administration of chorionic gonadotropin (LH) at a dose of 100 IU/kg induces spermatogenesis in the male carp.—Copyright 1975, Biological Abstracts, Inc. W76-06787

PETROLEUM-OXIDIZING BACTERIA FROM THE GULF OF FINLAND, (IN RUSSIAN), Dep. Moscow State Univ. (USSR). Dept. of Microbiology. T. V. Koronelli, I. Inskii, and E. S. Kudrina. Biol Nauki 18(2); p 107-111, 1975.

Descriptors: *Bacteria, Europe, Oxidation, Oil pollution, Oil spills, *Mycobacterium, *Oil wastes. Identifiers: Anthrobacter-Sp., *Gulf of Finland, Mycobacterium-Ceroformans, Mycobacterium-Convolutum, Mycobacterium-Hyalinum, Mycobacterium-Mucosum.

From an oil slick collected near the shore of the Gulf of Finland, petroleum-oxidizing bacteria were isolated which were identified as *Mycobacterium mucosum*, *M. convolutum*, *M. ceteroformans* (*Arthrobacter* sp.) and *M. hyalinum*. A description of these microorganisms is given. The isolated bacteria grow well on a medium with normal hydrocarbons or crude oil. A check of the ability of the cultures to attack petroleum in a synthetic medium containing 1.1% crude oil as the sole organic substance established that oil is decomposed 5-070% by pure cultures and 80% by mixed cultures.—Copyright 1975, Biological Abstracts, Inc. W76-06788

5D. Waste Treatment Processes

DISPOSAL OF SOLUBLE INORGANIC SALTS, Tulsa Univ., Okla.

F. S. Manning, and N. D. Sylvester. Available from the National Technical Information Service, Springfield, Va. 22161 as PB-251 556, \$3.50 in paper copy, \$2.25 in microfiche. Oklahoma Water Resources Research Institute, Stillwater, Completion Report, (1974), 6 p. OWRT A-047-OKLA(1).

Descriptors: *Membranes, *Salts, *Dissolved solids, Ions, Waste water treatment, Separation techniques, Design, Construction, Desalination. Identifiers: Hydrous oxide membranes, Laboratory flow cell system.

Dynamic hydrous oxide membranes, recently developed at Oak Ridge National Laboratory, offer the possibility of removing total dissolved solids and of separating monovalent ions from polyvalent ones during concentration; thus creating new possibilities for later steps such as fractional crystallization. The goal of this research project was the design and construction of a laboratory flow cell system for the evaluation of these dynamic hydrous oxide membranes. The flow system has been designed, constructed, and evaluated on a preliminary basis. A schematic diagram of the entire experimental flow system is presented. W76-06156

MARINE POLLUTION CONTROL: PART III—SHIP DESIGN REQUIREMENTS: THE DESIGN APPROACH,

Naval Ship Engineering Center, Hyattsville, Md. Environmental Pollution Control Branch. A. E. Constant. Naval Engineers Journal, Vol. 87, No. 5, p. 47-55, 1975. 4 fig, 3 ref.

Descriptors: *Oceans, *Water pollution control, *Ships, *Naval architecture, *Design, Waste disposal, Equipment, Solid wastes, Sewage treatment, Plumbing, Incineration, Oil wastes. Identifiers: Compactors.

Techniques available to control shipboard generated wastes are discussed to stimulate interest in this area of ship design and to increase use of environmentally attractive systems and components. Correct location of pollution control equipment on ships will aid the crew and be less complicated and more economical to operate. Especially important are the needs for direct drainage flow and location of solid waste handling equipment. The discussion is directed to the Collection, Holding, and Transfer (CHT) systems. These systems are flexible, require only minor modification of existing plumbing, but require pier sewers or barging facilities, and entail only minor associated costs. There are two basic CHT systems. One uses a comminutor in the drain line into the holding tank, while the other uses an overflow box and inflow strainers. Incinerators, compactors, and food waste disposers needed to conform to regulations or requirements for shipboard generated solid waste disposal are described. The design for oil waste handling, stowage, transfer, and processing systems is discussed. Several suggestions are given for controlling oily ballast water. Residual oil should be removed from tanks and overflows from tanks arranged to prevent direct overboard discharge. (Buchanan-Davidson-Wisconsin) W76-06196

UTILIZATION OF ANIMAL MANURES AND SEWAGE SLUDGES IN FOOD AND FIBER PRODUCTION,

Iowa State Univ. of Science and Technology, Ames. Council for Agricultural Science. Report No. 41, February 1975. 27 p.

Descriptors: *Beneficial use, *Farm wastes, *Recycling, *Sewage sludge, Feeds, Fertilizers, Soil Amendments, Economics, Hazards, Sewage disposal, Salts, Sludge disposal, Agriculture, Heavy metals, Water pollution, Management, Land reclamation, Benefits, Public health, Crop response, Odor.

Proper use of animal manure and sewage sludges as fertilizers, soil additives, and animal feed could improve water and air quality and save fuel and feeds resources. Application to agricultural and forest lands is influenced by physical, chemical, microbiological, sociological, economic, political, and legal factors. Limitations to use as fertilizers are bulk, low quality, variable composition, inefficiency of application and expense of transportation. They may require drying, are difficult to store, and may contain large quantities of soluble salts (especially nitrates), heavy metals, pathogenic microorganisms, odors, etc. Fear of disease has hindered use of animal manure in animal feeds. Decreasing salts, trace metals, and bacteria accompanied by quality control would make these waste products more competitive with chemical fertilizers. Conservation of the ammonia produced and development of storage systems would be beneficial. Guidelines for use which are based on facts and acceptable risks and which can be interpreted in terms of local and regional conditions are needed to protect public health and environmental quality. Educational, research, and demonstration projects would improve management of sewage sludges and animal manures and would convince the population that their use can be beneficial. (Buchanan-Davidson-Wisconsin)

W76-06198

TECHNOLOGY AND \$20 BILLION ADVANCE WASTEWATER TREATMENT EFFORT.

Engineering News Record, Vol. 195, No. 13, p. 18-19, 21-22, 24, 26, 29, 31. October 2, 1975. 5 fig, 1 tab.

Descriptors: *Water quality, *Sewage treatment, *Waste water treatment, *Sewage effluents, *Tertiary treatment, Filtration, Reverse Osmosis, Activated carbon, Phosphorus, Nitrogen, Biochemical Oxygen demand. Identifiers: Water Pollution Control Act of 1972.

About \$24.8 billion needs to be spent to treat the 30 billion gallons of wastewater which will be produced each day in the US by 1990. The technology to provide Advanced Waste Treatment (AWT) is available but the costs are high and there is also a backlog of secondary treatment projects designed to meet somewhat lower effluent standards which must be met by 1977. Problems must be approached on a case by case basis. Nature of the influent waste and receiving streams, and other factors are important. AWT can replace biological treatment with physical and chemical processes or it can refine secondary effluent. Removal of phosphorus has received top priority and is less expensive than removal of other wastes. Removal is accomplished by using lime, alum, or ferric chloride at one of several points in the treatment process. The additive reacts to form a solid which precipitates. Nitrogen removal is more difficult and more often questioned, though this element can be toxic to fish, corrode copper and increase chlorine consumption in disinfection. Removal of dissolved organics is accomplished with activated carbon, and is also possible through ozone oxidation though it is more expensive. However, this is less expensive than reverse osmosis, a process which removes almost all pollutants by forcing wastewater through a semi-permeable membrane of cellulose acetate. This is a high energy system useful in some industrial settings only. No single system can accomplish all treatment goals and the basic engineering involved is evolutionary not revolutionary. Costs are putting a severe strain on development. Prospect of meeting the zero-discharge objective of the Water Pollution Control Act of 1972 is dim. (Smith - North Carolina) W76-06271

IMPACT OF THE SEWAGE WORKERS' STRIKE ON THE RIVER CLYDE, Clyde River Purification Board, Glasgow (Scotland).

For primary bibliographic entry see Field 5C. W76-06281

UPGRADING PRIMARY TREATMENT WITH CHEMICALS AND WATER TREATMENT SLUDGE,

Greeley and Hansen, Chicago, Ill. T. E. Wilson, R. E. Bizzarri, T. Burke, P. E. Langdon, and C. M. Courson. Journal Water Pollution Control Federation, Vol. 47, No. 12, p 2820-2833, December, 1975. 12 fig, 7 tab.

Descriptors: *Waste water treatment, *Suspended solids, *Biochemical oxygen demand, Coagulation, Nutrient removal, Polymers. Identifiers: Chemical treatment, Sludge handling, Alum, Phosphorus removal.

In order to upgrade the quality of effluent water in Tampa, Florida, a study was undertaken to develop a chemical treatment program and a sludge handling program. A preliminary laboratory screening of processes indicated that a combination of alum and high-molecular weight anionic polymer would be a promising coagulant. Other preliminary studies indicated that suspended

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solids (SS) removal could be correlated with phosphorus removal and that there was a relationship between alum dosage and effluent SS concentration. During the main study alum and polymer were added to the influent on a 24-hr/day basis and the alum was paced according to the orthophosphorus concentration. This concentration was about 2 mg/liter, corresponding to an estimated effluent SS concentration of about 30 mg/liter. The effluent SS remained below 30 mg/liter when the effluent orthophosphorus was below about 1.6 mg/liter. When chemicals were added the percentage removal and effluent concentrations of BOD and SS were superior to those when no chemicals were added. Because laboratory tests indicated that addition of water works sludge should improve performance and SS removal, it was attempted. Each time sludge was discharged to the system, performance suffered. It was then hypothesized that the sludge was being taken at too high a rate, and, upon regulation, the sludge was accepted. At times of high waste water flow or low water works sludge discharge, alum was necessary to maintain high removal efficiencies. The resulting raw sludge was slightly lower in solids content but no other significant changes from previous operation were noted. (Loustau-FIRL)

W76-06286

AN ECONOMIC STUDY OF THE UNOX AND CONVENTIONAL AERATION SYSTEMS, J. M. Sidwick, T. P. Lewandowski, and K. H. Allum.

Water Pollution Control, Vol. 74, No. 6, p 645-656, 1975. 5 fig, 3 tab, 3 ref.

Descriptors: *Aeration, *Activated sludge, *Oxygenation, *Operating costs, *Capital costs, Biological treatment, Sewage treatment. Identifiers: UNOX system.

The cost of the Unox treatment system was compared with conventional aeration systems. The Unox system differs from the activated sludge process primarily in that oxygen-enriched air is the source of oxygen for the microorganisms in the aeration tank. Although the process has been known for a long time, it was thought to be impractical cost-wise. A system using a staged reactor and a covered tank in such a manner as to achieved 90% utilization of the generated oxygen gas was linked up with an oxygen-production unit employing molecular sieves. The new system, the basis of the Unox system, allowed comparatively low cost production of oxygen in small tonnage requirements. Process parameters of the Unox system and the conventional activated-sludge system are given and the capital and operating costs are then compared. The total capital costs of the Unox plant were lower throughout the range of flows and treatment systems considered, but the operating costs were higher for the Unox system. The lowest plant capital costs resulted from treating unsettled sewage. The higher operating costs when operating on unsettled sewage offset any gains in reduced capital expenditure on these plants. Circular Unox treatment units were cheaper than rectangular for most of the systems considered. The Unox system offered a treatment process which was directly competitive with conventional aeration processes throughout the plant range studied. The process would be best operated on settled sewage in the United Kingdom to avoid any problems with sludge disposal. (Loustau-FIRL)

W76-06288

NOVEL AERATION SYSTEM BOWS, Imperial Chemical Industries Ltd., Billingham (England). Agricultural Div. D. A. Hines, M. Bailey, J. C. Ousby, and F. C. Roesler.

Water and Wastes Engineering, Vol. 12, No. 12, p 59-64, December, 1975.

Descriptors: *Aeration, *Waste water treatment, *Biological treatment, Separation techniques, Microorganisms, Activated sludge, Pilot plants. Identifiers: Deep shaft.

A new aeration process for effluent treatment has been developed as a spin-off from basic aerobic fermentation technology for single cell protein development. Using a deep shaft, the process operates as a modified air-lift fermenter with air injection and may be used for municipal or industrial waste of any strength. It differs from the single cell protein production technology in that the air-lift type of fermenter not only provides biological oxidation but also provides the driving force for liquid circulation. A deep shaft, partitioned into two sections, forms the basis of the process design. Liquid effluent enters the apparatus continuously and is circulated by air pressure many times around the shaft during its time in the system. It then overflows by gravity for solids separation. To establish the effect of pressure oscillations on microorganisms in the activated sludge, a simple experiment was carried out. Nitrogen sparged at varying pressures through a vessel half-filled with activated sludge produced no decrease in viability or respiratory activity of the sludge. Electron micrograms and investigation by light-microscopy showed no evidence of cell rupture. Results from the deep shaft pilot plant have confirmed the validity of these initial experiments. The advantages of the deep vertical shaft are the minimal land requirement, the elimination of primary settlement, less sludge for disposal, the easily-supplied oxygen requirement, and the possible combination of activated sludge and aerobic digestion duties in a single shaft. (Loustau-FIRL)

W76-06289

MOVING BED FILTER PERFORMANCE STUDIES, Research Triangle Inst., Research Triangle Park, N.C. F. O. Mixon.

Chemical Engineering Progress, Vol. 71, No. 12, p 40-46, December, 1975. 6 fig, 2 tab, 5 ref.

Descriptors: *Filters, *Filtration, *Sewage treatment, *Waste water treatment, Equipment, Suspended solids, Recycling, Cleaning, Flow rates. Identifiers: Moving bed filter.

The advantages of a new moving bed filter in treating both raw sewage and secondary effluents is that the filter medium is continually removed, cleaned, and recycled to the filtration zone. This moving bed contactor process should compete with and perhaps replace clarification, fixed bed filtration, microscreening and moving bed filters of countercurrent or crosscurrent design. The advantages of the moving bed contactor are that the equipment is simple, the filter can handle high and low suspended solids concentrations, the continuous operation feature simplifies materials handling and process automation, there is an inherent headloss stability, and its mechanism is analogous to graded filter media. In this moving bed process, the filter medium is slurried with incoming process feed and fed to the bottom of the moving bed contactor. Once inside, the filter medium rises because of buoyancy and viscous drag to the bottom of the perforated porous plug of filter medium where it is deposited and thus replenishes the porous plug. Water is forced through the plug and is discharged by gravity at the lateral retaining screens, simultaneously undergoing filtration and forcing the plug slowly upward. At the top of the column, the emerging porous plug is harvested by a mechanical scraper and discharges filter medium into an auxiliary tank from which it is washed and returned to the process. After a year's testing, data showed that from 62 to 82% of the suspended solids in raw sewage was removed by the moving bed unit at flow rates ranging from around 3.5 to 7.5 gal/min/sq ft. (Loustau-FIRL)

W76-06290

CAERNARFON SLUDGE GOES UP IN SMOKE, For primary bibliographic entry see Field 5E. W76-06291

SLUDGE DISPOSAL ALTERNATIVES, Camp, Dresser and McKee, Inc., Boston, Mass. For primary bibliographic entry see Field 5E. W76-06292

THERMOPHILIC MICROBIOLOGICAL TREATMENT OF HIGH STRENGTH WASTE-WATERS WITH SIMULTANEOUS RECOVERY OF SINGLE CELL PROTEIN,

Illinois Univ. at Urbana - Champaign. Dept. of Civil Engineering.

G. A. Surucu, R. S. Engelbrecht, and E. S. K. Chian.

Biotechnology and Bioengineering, Vol. 17, No. 11, p 1639-1662, November, 1975. 10 fig, 3 tab, 38 ref.

Descriptors: *Waste water treatment, *Kinetics, *Aerobic conditions, *Thermophilic bacteria, *Biological treatment, Model studies, Chemical oxygen demand, Proteins, Biomass. Identifiers: Solids retention time.

To determine the kinetic and operating parameters of a thermophilic system of waste water treatment, the kinetic coefficients of an aerobic thermophilic mixed culture system were calculated, the effects of solids retention time (SRT) on the biomass was demonstrated, and the economics of protein recovery were assessed. A mixed culture of thermophilic organisms from soil, streams, waste water, and silage was prepared and studied for various growth characteristics at 58°C in a medium containing glucose, the carbon source, and other nutrients. The biomass was then measured for cell mass, COD, and protein content. A series of experiments were performed at eight different SRT values. The resulting data were then applied to the Monod kinetic model. The kinetic parameters of saturation constant, substrate utilization rate, and death rate for a thermophilic system were much higher than those of a mesophilic system, while the yield coefficient was somewhat lower. Over 90% removal of soluble COD was observed with a SRT of two days and it improved with increasing SRT. The protein content of the biomass increased as the dilution rate decreased. However, because of a significant increase in the apparent cell yield with higher dilution rates, the net protein yield was found to increase with increasing dilution rates. A decrease in oxygen consumption per unit quantity of protein produced with increasing dilution rates also favored the economics of protein production. (Loustau-FIRL)

W76-06293

A TECHNIQUE FOR ESTIMATING ACTIVE NITRIFYING MASS AND ITS APPLICATION IN DESIGNING NITRIFYING SYSTEMS,

New York State Coll. of Agriculture and Life Sciences, Ithaca. Dept. of Agricultural Engineering.

For primary bibliographic entry see Field 5A. W76-06296

STATISTICAL DESIGN OF EQUALIZATION BASINS,

Hydrosience, Inc., Westwood, N.J. D. M. Di Toro.

Journal of the Environmental Engineering Division, Proceedings of ASCE, Vol. 101, No. EE6, p 917-933, December, 1975. 12 fig, 1 tab, 10 ref.

Descriptors: *Design criteria, *Statistical analysis, flow rates, *Waste water treatment. Identifiers: *Equalization basins.

The major design problem in smoothing out fluctuations of concentration and mass flow rate in an

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equalization basin is to relate the characteristics of the fluctuating influent to those of the equalized effluent, as a function of the detention time. Presented here are the results and conclusion of two types of characterizations of the influent in graphical and tabular form suitable for design purposes. An analysis presented in subsequent sections addresses the questions of what are the statistics of the effluent concentration and effluent mass flow rate, and what is the probability that the effluent concentration exceeds a given design value. It is concluded that the equalization basin is a device that can be used to control variability in much the same way that conventional treatment units control mean values. As a post-treatment device, an equalization basin may be designed to meet variability criteria that would be difficult to achieve in the reactive units of the system. (Loustau-FIRL)
W76-06297

COMPUTERIZED MONTHLY REPORTS, COST-EFFECTIVE ALTERNATIVE,
Massachusetts Univ., Amherst. Dept. of Civil Engineering.
For primary bibliographic entry see Field 7C.
W76-06300

THE EFFECT OF SOME CARBON SUBSTRATES ON MORPHOLOGY OF FLOCS AND QUANTITATIVE RELATIONS AMONG MICROORGANISMS IN ACTIVATED SLUDGE,
Warsaw Univ. (Poland). Zaklad Mikrobiologia Wody Sci.; and Warsaw Univ. (Poland). Dept. of Water and Sewage Microbiology.
E. Bieszkiewicz, and E. Lapias.
Acta Microbiologica Polonica, Vol. 7, No. 1, p 55-59, 1975. 3 tab, 7 ref.

Descriptors: *Activated sludge, *Sewage, *Waste water treatment, Microorganisms, Bacteria, Measurement, Analytical techniques.
Identifiers: Carbon substrates, Glucose, Sodium acetate, Gallic acid, Floccs.

The effect of glucose, sodium acetate, and gallic acid substrates on microorganisms of activated sludge were studied. A synthetic activated sludge was cultured in sewage for four weeks and samples were removed every three days. Each sample was measured for the number and size of floccs; for the number of flagellata and the number of free-living, creeping, and settled ciliata by the direct count method and the plate method; for volume index; and for oxygen demand. Great differences were found in the appearance, size, and number of floccs of the activated sludge cultures. In the sludge cultured with sodium acetate, the floccs were ramified. In the culture with glucose, the floccs were irregular and had folded margins and fine-grain structure. In the gallic acid culture, the floccs were of a similar appearance but were much smaller and twice as numerous. A greater number of bacteria were aggregated in the acetate and glucose sewage than in the gallic acid sewage. The number of free-living bacteria declined in the acetate sewage, but remained constant in the glucose sewage. In the gallic acid culture the number of free-living bacteria was greater than that of the aggregated organisms for the whole period of experiment. Flagellata, which developed in the early part of the experiment, decreased as settled ciliata increased. Purification of the glucose sewage reached 76%, that containing sodium acetate, 87%, and that containing gallic acid, 61%. (Loustau-FIRL)
W76-06302

CADMIUM AND ZINC CONTENTS OF CORN LEAF AND GRAIN PRODUCED BY SLUDGE-AMENDED SOIL,
Illinois Univ. at Urbana-Champaign. Dept. of Agronomy.
For primary bibliographic entry see Field 5A.
W76-06304

A FEW CONSIDERATIONS ON THE MEASUREMENT OF PORE SIZE DISTRIBUTION OF ACTIVATED CARBON (KASSEITAN NO SAIKOKU BUNPU SOLUTEI NI KANSURU 2,3 NO KOSATSU),
S. Sato, K. Najima, K. Yoshikawa, and Y. Inagaki.
Mitsubishi Juko Giho, Vol. 12, No. 5, p 535-542, 1975. 14 fig, 5 tab, 12 ref.

Descriptors: *Waste water treatment, *Analytical techniques, *Activated carbon, Water treatment, Adsorption.
Identifiers: Pore size distribution, Activated carbon microstructure.

Increasingly stringent pollution control standards and the demand for the reuse of water have increased the use of activated carbon for waste water treatment. A study of the microstructure of activated carbon is important since the microstructure is closely related to the adsorbing performance of the carbon. The nitrogen adsorption method and the mercury pressure-penetration method were used to study the microstructure of activated carbon. The accuracies of these methods and analytical procedures are discussed. Measuring techniques for specific surface area, pore volume, and pore size distribution were established. Results from the investigations of the pore size distribution of activated carbon used for water treatment have shown that these analytical techniques can be used as important evaluating means for virgin carbon, spent carbon, and regenerated carbon. (Orr-FIRL)
W76-06309

GOVERNMENT-CONTRACTOR-ENGINEER LIASON THAT CREATES AN ECONOMICAL PROJECT,
For primary bibliographic entry see Field 5F.
W76-06319

WATER QUALITY MANAGEMENT FOR METROPOLITAN KANSAS CITY,
Black and Veatch, Kansas City, Mo.
For primary bibliographic entry see Field 5G.
W76-06323

DEALING WITH THE DISCHARGE MONITORING REPORT,
San Antonio Wastewater Treatment Plant, Tex.
For primary bibliographic entry see Field 5G.
W76-06325

HEALTH SIGNIFICANCE OF AIRBORNE MICROORGANISMS FROM WASTEWATER TREATMENT PROCESSES, PART I: SUMMARY OF INVESTIGATIONS,
North Carolina Univ., Chapel Hill. Dept. of Environmental Sciences and Engineering.
For primary bibliographic entry see Field 5C.
W76-06326

HEALTH SIGNIFICANCE OF AIRBORNE MICROORGANISMS FROM WASTE WATER TREATMENT PROCESSES, PART II: HEALTH SIGNIFICANCE AND ALTERNATIVES FOR ACTION,
North Carolina Univ., Chapel Hill. Dept. of Environmental Science and Engineering.
For primary bibliographic entry see Field 5C.
W76-06327

CONTROLLING POLLUTION FROM COMBINED SEWERS,
Hydrocomp, Inc., Palo Alto, Calif.
R. K. Linsley.
Simulation Network Newsletter, Vol. 7, No. 5, p 1-4, July 1, 1975. 4 fig.

Descriptors: *Storage capacity, *Sewage treatment, *Hydrology, Economics, Model studies, Economics, Flow, Simulation analysis, Flood control, Planning.
Identifiers: Hydrocomp Simulation Program (HSP).

If the 1985 target for pollution control is to be met, billions of dollars must be spent for storage facilities for sewage flows awaiting treatment. Determination of the required storage capacity is a hydrologic and economic problem. The Hydrocomp Simulation Program (HSP) is a continuous flow simulation that can give the most accurate estimates for storage requirements and configurations possible. HSP can also define the probability that the discharge of pollutants into receiving waters would exceed limits. If they did not, storage could be reduced. Since such probabilities would vary, even within the period of a day, the program must be produced very rapidly and accurately. The principle of flow storage is similar to that of flood control by reservoirs. The major differences are that the projected costs of flow storage are three times the expenditures to date on flood control, and that there are few records of sewer flows that can be used for design purposes. These factors necessitate the use of careful planning from simulated models. (Loustau-FIRL)
W76-06328

PHOSPHATE SORPTION CHARACTERISTICS OF SOILS TREATED WITH DOMESTIC WASTE WATER,
Connecticut Agricultural Experiment Station, New Haven.
For primary bibliographic entry see Field 5B.
W76-06330

MANAGEMENT OF AN EFFECTIVE MAINTENANCE PROGRAM,
California State Univ., Sacramento. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5G.
W76-06333

NUTRITIONAL AND PHYSIOLOGICAL EFFECTS OF NITRATES, NITRITES, AND NITROSAMINES,
Florida Univ., Gainesville. Dept. of Animal Science.
For primary bibliographic entry see Field 5C.
W76-06334

EFFECTS OF SALINITY ON NITRIFICATION IN THE EAST RIVER,
New York State Dept. of Health, Albany. Div. of Labs. and Research; New York State Dept. of Health Albany. Environmental Health Center.
For primary bibliographic entry see Field 5C.
W76-06335

FULL AUTOMATION GOAL OF WATER RECLAMATION PLANT,
Brown and Caldwell, Inc., Walnut Creek, Calif. Process Control Div.
M. J. Flanagan.
Water and Wastes Engineering, Vol. 12, No 12, p19-24, 58, December, 1975. 5 fig, 3 tab.

Descriptors: *Computers, *Data processing, *Control systems, Treatment facilities, Waste water treatment, Water reuse, Biological treatment, Automatic control, Construction costs.
Identifiers: Water reclamation plant, Physicochemical treatment.

A system of distributed digital processors and peripheral equipment is employed for data acquisition, process control and data management in a new 30 mgd water reclamation plant. The process control and management information system is

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currently undergoing factory testing prior to delivery to the plant site. The entire digital system was connected to an analog computer programmed on a real time basis to simulate portions of the waste water treatment process. The system is built around a hierarchical network of digital computers consisting of two minicomputer systems and 24 microcomputer systems. The cost of the system, including all field instrumentation and telemetry equipment, represents 4.0% of the total plant construction cost. The system can be expanded whenever the plant is expanded. Both computer systems are provided with a real-time operating system so that either system can be assigned to real-time process control. The computers will regulate the functions of the plant processes, log operational data, schedule a maintenance program, keep an inventory, assign personnel, and store and retrieve historical data. The alarm system works in such a way that the operator is only informed of abnormal functioning. The plant in which the computer system will be installed is a physical-chemical-biological process and incorporates lime clarification in the primary sedimentation tanks, biological nitrification-denitrification, and a two-stage centrifugal classification and clarification process with recalcining and lime recovery. The denitrified plant effluent is filtered by a multimedia rapid sand filtration system and chlorinated prior to distribution for reuse by industry. (Loustau-FIRL)
W76-06337

PRACTICAL RESEARCH IN WATER POLLUTION CONTROL,
University Coll., Cardiff (Wales). Dept. of Microbiology.
C. F. Forster.
Water Pollution Control, Vol. 74, No. 6, p 625-634, 1975. 7 fig, 5 tab, 24 ref.

Descriptors: *Waste water treatment, *Research and development, Activated sludge, Treatment facilities, Bacteria, Water pollution control, Nitrification, Sludge disposal.

Relative to problems in the waste water treatment industry, particularly aspects of sludge bulking, nitrification, and sludge disposal, some current fields of research are discussed. The settling characteristics of sludge have a considerable influence on the quality of final effluent. Deterioration in the settling properties of activated sludge, or bulking, is an ever-present threat to treatment plants. There are two theories on the causes of bulking: one is that a bulked sludge is one that has become grossly infected by filamentous microbes, and the other is that bulking is due to variations in the surface of the sludge. As a result of studies based on the latter theory, it has been suggested that the accumulation of lysozyme sensitive material in the sludge caused by the death of bacteria could be one cause of bulking. Another cause could be the depolymerization of slime layer polysaccharide. Since present standards for discharge are inadequate and the amount of nitrogenous matter converted to ammonia must be minimized, nitrifying systems are being studied. One solution calls for a separate nitrifying system in which the biomass is composed more or less exclusively of nitrifying bacteria and in which the sludge age is high. Another solution is submerged filtration in which there is a co-current flow of liquid and air upwards through a packed bed upon which the nitrifying flora develops. For the disposal of waste sludge, two possibilities show commercial potential. One use is the supplementation of animal feed, and the other is conversion into fermentation feedstock. (Loustau-FIRL)
W76-06340

ZERO DISCHARGE TO THE ENVIRONMENT OF DIFFICULT WASTEWATERS,
M. A. Elshazly.
In: Complete WasteReuse: Industry's Opportunity, April 23-27, 1973, American Institute of Chemical

Engineers and Environmental Protection Agency--Technology Transfer, p 147-151. 1 fig.

Descriptors: *Waste water (Pollution), *Waste water disposal, *Waste water treatment, *Chemical wastes, Industrial wastes, Oil, Costs, Incineration, Evaporation, Organic matter, Ultimate disposal, Water reuse.
Identifiers: Carver-Greenfield process, Waste streams, Multi-evaporation process, Zero discharge.

Contaminated waste waters from the chemical processing industry vary so much in composition that treatment by chemical or biological methods is very difficult. Such wastes were previously dumped in deep wells, dumped in the ocean, or incinerated. A multi-evaporation process, called the Carver-Greenfield process, has been used in the food processing industry successfully and is now finding application in the recycling and ultimate disposal of chemical wastes. Oil is added to the liquid waste and the water is evaporated. The resulting moisture free oil-solid suspension is separated by centrifugation. Since tighter environmental standards have made the cheaper methods of disposal ecologically unsound, the Carver-Greenfield process previously considered too costly, is becoming a viable alternative. Two types of waste streams are considered. The first is 20,000 lbs/hr with 7% dissolved organic material from a pharmaceutical manufacturer, and the second is 117,000 lbs/hr, containing 9% oil and 3% solids from an oil refinery. In the first plant, incineration was adopted at a cost of 169,000 dollars. If the Carver-Greenfield process were used, it would cost 92,000 dollars per year. In the second plant, incineration costs 1,018,500 dollars, while the Carver-Greenfield process costs 350,000 dollars. (See also W76-05314) (Pinto-FIRL)
W76-06341

HOW TO IMPROVE PLANT EFFICIENCY,
Environmental Protection Agency, Washington, D.C. Office of Water Programs Operations.
For primary bibliographic entry see Field 5G.
W76-06342

REVEGETATING BITUMINOUS STRIP-MINE SPOILS WITH MUNICIPAL WASTEWATER, PART II: QUALITY THE LEACHATE AND SPOIL CHEMICAL CHANGES,
Pennsylvania State Univ., University Park. Dept. of Forest Hydrology.
B. R. Edgerton, W. E. Sopper, and L. T. Kardos.
Compost Science, Vol. 16, No. 5, p 10-15, Autumn, 1975. 1 fig, 4 tab, 5 ref.

Descriptors: *Waste disposal, *Sludge disposal, *Toxicity, *Land reclamation, Model studies, Environmental effects, Irrigation, Leachates, Nitrogen, Waste water (Pollution), Eutrophication.
Identifiers: Renovation, Acid mine drainage, Land application.

Stripmining causes acid mine draining that can result in a sterile aquatic ecosystem. In order to try to ameliorate the toxicity and acidity of strip-mine spoil, a study was conducted on the changes effected by effluent and sludge irrigation on spoil material. In a model study, boxes of highly toxic spoils were planted with legume and grass seeds, and irrigated with amounts of effluent and sludge. Upon analysis of spoil and leachate chemical composition, it was found that effluent and sludge treatment of the spoil material could ameliorate the conditions of toxicity and acidity. Leachate nitrogen levels may be increased, however, resulting possibly in detrimental eutrophication of waterways. (See also W76-03821) (Loustau-FIRL)
W76-06343

ANAEROBIC DIGESTION OF SLUDGE, PART II,
Pirnie (Malcolm), Inc., Paramus, N. J.
A. F. Weland, and P. N. Cheremisinoff.

Water and Sewage Works, Vol. 122, No. 11, p 45-47, November, 1975. 3 fig, 1 tab, 30 ref.

Descriptors: *Design criteria, *Anaerobic digestion, *Biological treatment, Waste water treatment, Alkalinity, Toxicity, Equations, Kinetics, Sludge treatment.
Identifiers: Solid retention time.

The design parameters of anaerobic digestion are reviewed, with emphasis placed on specific advantages and disadvantages of the process. The physical parameters of anaerobic digestion are detention time, temperature, influent solids concentration, mixing, and solids loading. Temperature and detention time are interrelated. If bacterial growth is stimulated by temperature, the stabilization rate increases. Solids retention time is generally 10 to 15 days. Solids retention time (SRT), solids loading, and volatile solids concentration are also interrelated. If solids loading is 0.10 lb VSS/cu ft/day and SRT is 10 days, then a minimum of 1.5% volatile solids is required. The chemical parameters of anaerobic digestion are pH, alkalinity, volatile acid, nutrients, and toxic materials. Alkalinity and pH are interrelated. Ideal environmental conditions are pH values of 6.6 to 7.4. The ratio of volatile acids to total alkalinity should be approximately 0.5. Sludges from sewage treatment plants and meat packing houses contain all the necessary nutrients, but wastes containing carbohydrates of fats require additional nutrient or seed materials. Industrial wastes are usually the cause of toxicity. This may be eliminated or reduced by dilution, precipitation, use of antagonist ions, process by-pass, or process modification. An equation was developed for the kinetics of digestion. The development of high rate systems has improved the overall efficiency of anaerobic digestion, but recent advances in incineration processes indicate a trend toward the replacement of the digestion process. (See also W76-03827) (Loustau-FIRL)
W76-06344

DETERGENT PHOSPHATE BAN YIELDS LITTLE PHOSPHORUS REDUCTION, PART II,
Purdue Univ., Lafayette, Ind. Dept. of Environmental Engineering.
For primary bibliographic entry see Field 5G.
W76-06345

DETERGENT PHOSPHATE BAN YIELDS LITTLE PHOSPHORUS REDUCTION, PART III,
Purdue Univ., Lafayette, Ind. Dept. of Environmental Engineering.
For primary bibliographic entry see Field 5G.
W76-06346

INSTRUMENTS FOR WATER AND SEWAGE TREATMENT PLANTS (JOGESUIDO KEISO KIKI),
Tokyo Shibaura Electric Co., Ltd. (Japan).
For primary bibliographic entry see Field 7B.
W76-06347

EVALUATION OF IN-LINE AND SIDE-LINE FLOW EQUALIZATION SYSTEMS,
G. W. Foess, J. G. Meenahan, and D. Blough.
Water and Sewage Works, Vol. 122, No. 11, p 59-60, November, 1975.

Descriptors: *Waste water treatment, *Treatment facilities, Biochemical oxygen demand, Municipal wastes, Flow, Evaluation.
Identifiers: *Flow equalization.

Despite advantages ascribed by various investigators, flow equalization has not been widely applied in the municipal pollution control field because of uncertainties in the areas of costs and beneficial effects. Two waste water treatment facilities, one employing side-line equalization, and the other employing in-line equalization, were evaluated for

impact on waste water characteristics, treatment process performance, and plant operating costs. Both equalization systems were highly effective in smoothing influent flow variations and providing a uniform flow rate to the process units. However, contrary to previous statements, each system exhibited only limited effectiveness in concentration leveling. A five percent BOD reduction was noted across the in-line basin. Overall removal of soluble phosphorous and effluent quality appeared to be unaffected by flow equalization. (Loustau-FIRL) W76-06348

ACTIVATED BIO-FILTER PROCESS,

W. F. Owen, and A. F. Slechta.
Water and Sewage Works, Vol. 122, No. 11, p 60, November, 1975.

Descriptors: *Biological treatment, *Filters, *Filtration, Microorganisms, Ammonia, Biochemical oxygen demand, *Waste water treatment, *Activated sludge.
Identifiers: Cost-effectiveness, *Bio-filters.

The two-stage activated bio-filter process, employing both fixed film and activated sludge biologic reactors, is a new development in secondary treatment. The ABF is unique in that fixed and suspended growth microorganisms are utilized in the first-stage reactor, called the 'bio-cell'. The process includes a bio-cell lift station, a fixed film reactor, flow control and splitting, a short detention aeration basin, a clarifier, and return sludge facilities. In a trial run at Corvallis, Oregon, the ABF system, with an influent NH₃-N concentration of 45 mg/liter and a bio-cell loading of 350 lbs BOD day/1,000 cut ft, removed over 90% BOD and ammonia. The ABF can be applied for any biological waste treatment system. Low power and land use requirements make it suitable for municipal treatment plants. Standard techniques are used in design, construction, and operation of the ABF system. It has been shown to be cost-effective because the efficiency of the first-stage treatment necessitates only a small second-stage aeration basin. (Loustau-FIRL) W76-06349

REGIONAL WASTE WATER DEVELOPMENT PLAN: ANALYSIS OF EXISTING FACILITIES.

Alamo Area Council of Governments, San Antonio, Tex.
1971. Parts I, II, III. Various Paging. 30 fig, 2 tab.

Descriptors: *Regional development, *Waste treatment, *Quality control, Water quality, Waste disposal, Water analysis, Basins, Sanitary engineering, Biochemical oxygen demand, *Texas, *Treatment facilities, *Waste water treatment.
Identifiers: *San Antonio(TX), Cibolo Creek(TX).

The 43 waste treatment facilities within the San Antonio AACOG planning region have been analyzed by design criteria of the Texas State Department of Health. Plant design, component and overall capacities, and effluent quality sampling results for each plant are reported. It is recommended that the 19 treatment plants within the proposed City of San Antonio Regional System be consolidated to 3 facilities, and that the remaining 16 plants be phased out. Extensive sampling during the past 6 months indicates that there is widespread inadequacy in treatment. The Texas Water Quality Board has set standards for maximum allowable BOD (Biological Oxygen Demand) at 27 mg/l and TSS (Total Suspended Solids) at 27 mg/l on any grab sample of processed effluent. These standards were exceeded in almost 40% of the BOD tests and almost 60% of the TSS tests. It is also proposed that wastewater from the 6 plants in the Cibolo Creek watershed be collected and treated at two regional plants to be operated by the San Antonio River Authority. Sampling at these six plants shows that BOD standards are being exceeded in 40% of the samples and TSS are above the standards in 70% of the

samples. The remaining 17 plants in the region consist of 15 serving small rural communities and 2 operated by the US government. These facilities will not be made part of the regional system within the next few decades, although almost 90% of these facilities fail to meet the standards half the time, indicating a need for improved levels of treatment. (Herr - Carolina) W76-06351

SEWER/WATER PREFERRED LONG RANGE PLANS.

Northern Middlesex Area Commission, Lowell, Mass.
For primary bibliographic entry see Field 5G.
W76-06352

SEWER AND WATER FACILITIES IN THE NORTHERN MIDDLESEX AREA, SHORT RANGE PRIORITY PROGRAM 1972-1977.

Northern Middlesex Area Commission, Lowell, Mass.
For primary bibliographic entry see Field 5G.
W76-06353

LAND DISPOSAL OF SEWAGE SLUDGE, VOLUME I (NOVEMBER 1972 - MARCH 1973).

Guelph Univ. (Ontario).
For primary bibliographic entry see Field 5E.
W76-06365

MINE AND MILL WASTEWATER TREATMENT.

Environmental Protection Service, Ottawa (Ontario). Water Pollution Control Directorate.
Environmental Protection Service, Economic and Technical Review Report EPS 3-WP-75-5, December 1975, 141 p, 30 fig, 23 ref, 19 tab.

Descriptors: *Effluents, *Mills, *Mine water, Wastes, Mine drainage, Runoff, Consumptive use, Treatment facilities, Water pollution, Metals, Mining, Wastes, Costs, Acid mine water, Canada.
Identifiers: *Tailings, Canadian practice.

This report reviews the origin of water borne wastes (mine drainage, mill process effluent and surface runoff) encountered in metal mining and milling operations, and the associated chemical processes resulting in contaminated effluents. It deals with the types of contaminants normally encountered in wastewaters discharged from the industry and the technology currently employed for the abatement and control of water pollution. The design and operation of the most widely used treatment facility, the tailings pond, is covered in some detail. Treatment of acid mine water in the newer mechanical treatment systems is also reviewed, particularly with reference to the 5 lpgm pilot plant project recently completed at the Brunswick Mining and Smelting Company. One section deals with the economic impact of effluent treatment on the mining industry. The costs of constructing and operating sound environmental control systems are discussed. The data and method suggested for deriving such costs should prove helpful to professionals involved in the estimation and control of environmental protection costs. Several case studies covering treatment costs are included. (Environment Canada) W76-06373

REMOVAL OF PHOSPHATES AND METALS FROM SEWAGE SLUDGE,

Waterloo Univ. (Ontario). Dept. of Chemical Engineering.

D. S. Scott, and H. Horling.
Canada-Ontario Agreement on the Great Lakes Water Quality, Research Report No. 28, Training and Technology Transfer Division (Water), Environmental Protection Service, Environment Canada, Ottawa, Canada, (1973) 55 p., 11 fig., 19 ref., 8 tab. 73-5-7.

Descriptors: *Phosphates, *Sewage, Metals, Iron, Sludge, Heavy metals, Aluminum, Costs.
Identifiers: *Metal extraction, Organic material.

Most of the metals and phosphorus in either unconditioned or conditioned final anaerobically digested sludges can be readily extracted by acid. The acid extract can be neutralized under controlled conditions of pH to yield a solid product low in organic material containing mostly iron and aluminum phosphates. By proper control of pH, it is possible to produce two solid products, one containing most of the iron and aluminum, and one containing most of the heavy metals. Iron and phosphate can be separated and recovered from the crude inorganic product by known solvent extraction technology, or by alkali treatment. Costs are such that if metals and phosphates are removed from a sludge, then it is profitable to recover and recycle the iron and phosphate from the crude inorganic product. However, the value of recovered metals and phosphates is not sufficient to bear the cost of the entire process. (Environment Canada) W76-06375

A MODEL TO PREDICT THE PERFORMANCE OF FEEDLOT RUNOFF CONTROL FACILITIES AT SPECIFIC OREGON LOCATIONS.

Oregon State Univ., Corvallis. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 5B.
W76-06382

PROCESS OF REMOVING AMMONIACAL NITROGEN FROM WASTE WATER,

Iwao Engineering Co., Inc., Tokyo (Japan). (Assignee).
T. Hiasa, and H. Ishimard.
U.S. Patent No. 3,929,600, 9 p, 1 fig, 6 tab, 5 ref; Official Gazette of the United States Patent Office, Vol 941, No 5, p 2224, December 30, 1975.

Descriptors: *Patents, *Waste water treatment, *Water pollution treatment, Water pollution control, Water quality control, Ammonia, *Nitrogen compounds, Nitrogen, Chlorine adsorption, Electrolysis, Ion-exchange, Hydrogen ion concentration, Separation techniques, Chemical reactions.
Identifiers: *Ammonia nitrogen removal.

A method is disclosed for removing the ammonia nitrogen by conversion of the ammonia nitrogen to the inert nitrogen in a closed system, recycling the treating liquid, to prevent secondary pollution and by successive treatment, such as adsorption, elution electrolysis, adjustment of pH, and cleansing, of the drainage containing the ammonia nitrogen to improve removing ability. The ammonia nitrogen in effluent from waste water treatment plants is adsorbed in an ion-exchange substance such as zeolite and is eluted by treating the ion-exchange substance with a treating liquid containing mainly alkali metal chlorides to regenerate it. The treating liquid containing the ammonia nitrogen is electrolyzed to produce active chlorine which decomposes oxidatively. The gas generated by the decomposition is brought into contact with an adjusting liquid, containing a hydroxide of the same alkali metal as that used in the treating liquid. The adjusting liquid which has adsorbed the acid gas is added to the electrolyzed treating liquid to adjust hydrogen ion concentration, to supplement the alkali metal ion and decompose the remaining ammonia nitrogen by the recovered active chlorine. Finally the treating liquid is recirculated, after cleansing by passing through active carbon to decompose residual chlorine to the initial ion-exchange process. (Sinha - OEIS) W76-06463

SUBMERGED MULTIPORT DIFFUSERS FOR COOLING WATER DISCHARGE,

Massachusetts Inst. of Tech., Cambridge, Mass. (Assignee).
G. H. Jirka, and D. R. F. Harleman.

Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

Group 5D—Waste Treatment Processes

U.S. Patent No. 3,934,599, 4 p, 13 fig, 4 ref; Official Gazette of the United States Patent Office, Vol 942, No 4, p 1712, January 27, 1976.

Descriptors: *Patents, *Cooling water, *Thermal pollution, *Water pollution sources, *Waste water treatment, Electric powerplants, Diffusion Dispersion, Mixing, Temperature.
Identifiers: Multipoint diffusers.

Submerged multipoint thermal diffusers are devices for the discharge into ambient water bodies of large quantities of heated cooling water primarily from electric power generation. The need for such devices stems largely from environmental considerations, which require considerable mixing of the heated water, and hence temperature reduction, in order to limit ecological damages. For typical conditions the amount of required mixing, i.e., the dilution, varies between five and twenty. Furthermore, this mixing has to be obtained within relatively small areas, depending on the locality. The multipoint diffuser has a main pipe for submerged disposition at or near the bottom of a large body of water. It has a large number of nozzles oriented at predetermined variable angles to the axis of the pipe, the angle of orientation being a function of the axial location of the particular nozzle and the half-length of the main pipe. (Sinha - OEIS)

W76-06464

AUTOMATIC WATER DISTILLER,

For primary bibliographic entry see Field 5F.
W76-06469

PROCESS FOR THE TREATMENT OF WASTE WATERS CONTAINING SULFURIC ACID AND/OR AMMONIUM SULFATE,

Institut Francais du Pétrole, Paris. (Assignee).
J. Alagy, C. Busson, and M. Cessou.
U.S. Patent No. 3,935,100, 7 p, 4 fig, 6 ref; Official Gazette of the United States Patent Office, Vol 942, No 4, p 1873, January 27, 1976.

Descriptors: *Patents, *Waste water treatment, *Chemical wastes, *Industrial wastes, Water pollution treatment, Water pollution control, Water quality control, Chemical reactions, Separation techniques, Sulfates, Sulfides, Sulfur.

Identifiers: *Sulfuric acid, *Ammonium sulfate, Barium sulfide.

A process for treating a waste water containing sulfuric acid and/or ammonium sulfate comprises the steps of: reacting the waste water with barium sulfide, introduced at least partly in the solid state, so as to form a suspension of solid barium sulfate in waste water; reacting the resulting barium sulfate at high temperature with carbon (containing inorganic impurities) so as to form solid barium sulfide (containing inorganic impurities) and a gas which is separated; recycling to the first step at least the major portion of the formed solid barium sulfide; and dissolving in water a minor portion of solid barium sulfide from the second step, separating the resulting solution from the insoluble impurities. At least one portion of the resulting purified solution of barium sulfide is transferred to the first step. In this method sulfur can be recovered and recycled. (Sinha - OEIS)

W76-06470

CLARIFICATION PROCESS,

Georgia-Pacific Corp., Portland, Ore. (Assignee).
For primary bibliographic entry see Field 5F.
W76-06471

GEOHERMAL POWER SYSTEM AND METHOD,

For primary bibliographic entry see Field 3E.
W76-06472

APPARATUS FOR SEPARATING LOW-DENSITY LIQUID FROM A RELATIVELY MORE DENSE LIQUID SUBSTANTIALLY IMMISCIBLE THEREWITH,

Erdol-Raffinerie Neustadt G.m.b.H. and Co. (West Germany); and King-Wilkinson, Inc., Tulsa, Okla. (Assignee).
For primary bibliographic entry see Field 5G.
W76-06473

AUTOMATIC FOAM REMOVER FOR FLOTATION TANKS,

Waste Water System, Inc., Hoffman Estates, Ill. (Assignee).
C. E. Russell, F. E. Russell, and M. B. Pearson.
U.S. Patent No. 3,935,104, 4 p, 8 fig, 11 ref; Official Gazette of the United States Patent Office, Vol 942, No 4, p 1874, January 27, 1976.

Descriptors: *Patents, *Waste water treatment, *Water pollution treatment, Water pollution control, Water quality control, Industrial wastes, *Foam separation, Flotation, Separation techniques.

Identifiers: Vacuum.

An automatic foam removing apparatus is described for use in an industrial flotation system for the separation of suspended solids and immiscible liquids from a body of water. In a rectangular flotation tank gas bubbles are formed which rise through the waste water body carrying insoluble and immiscible matter with them to the surface to form a layer of froth, foam or sludge. The surface is maintained at a constant level by overflows. The foam remover comprises a hollow beam extending horizontally across the top portion of the tank and having its bottom edge at a distance above the waste water level with a downward open slot extending along the bottom edge. An elongate flat-faced vane is mounted within the hollow beam for pivotal movement on a horizontal axis above the slot and extending downward through the slot to a level below the surface. A conduit provides communication between a vacuum source and the interior of the hollow beam. The beam moves back and forth by means of a motor driven endless chain. Movement of the beam in one direction tends to cause compression of the foam in front and causes the vane to pivot into engagement with the rear edge of the slot and thus subjects the foam to the suction action and discharge of the foam through the conduit. The operation is repeated during the reverse movement of the beam with the vane in engagement with the other edge of the slot. (Sinha-OEIS)

W76-06474

TUBULAR FILTER IN SETTLER,

Henry Mfg. Co., Inc., Bowling Green, Ohio. (Assignee).
S. N. McEwen.
U.S. Patent No. 3,935,105, 6 p, 11 fig, 13 ref; Official Gazette of the United States Patent Office, Vol 942, No 4, p 1875, January 27, 1976.

Descriptors: *Patents, *Waste water treatment, *Industrial wastes, Water pollution treatment, Water pollution control, Water quality control, *Filtration, *Filters, Settling basins, Suspended particles, Separation techniques.

Identifiers: Filter cake.

A separator for solid particles from a liquid, such as a dirty industrial machine tool coolant, comprises a settling tank with one or more frames or assemblies of horizontally extending tubular filters. Each of the filter frames has a chamber into which all of the tubular filters connect. Socks are provided for the tubular filters and may contain seams that are aligned in vertical planes for the easy severance of the cakes of solid particles which build up upon them. A bottom drag out conveyor may be provided for the settling tank and a suction

pump draws the liquid through the filters into an adjacent clean tank. When the coating of removed solid particles on the tubular filters becomes excessive a predetermined vacuum occurs on the intake of the pump, the suction may be automatically shut down, and reverse pressure applied to the filters to bump off the cake that has formed on the filters so it can settle and be removed from the settling tank. If required a precoat filter medium may be applied to the filters. (Sinha - OEIS)

W76-06475

STRAINING APPARATUS,

AB Cellecto, Tumba (Sweden). (Assignee).
For primary bibliographic entry see Field 3E.
W76-06476

PROCESS FOR DEWATERING A PROTEINACEOUS, AQUEOUS SLUDGE AND FOR REMOVING AND RECOVERING PRECIPITATING AGENTS FROM A PRECIPITATE CONTAINING PROTEINACEOUS SUBSTANCES,

Apothekernes Laboratorium for Specialpræparator A/S, Oslo (Norway). (Assignee).
P. Nettli.

U.S. Patent No. 3,936,375, 7 p, 5 fig, 7 tab, 5 ref; Official Gazette of the United States Patent Office, Vol 943, No 1, p 336, February 3, 1976.

Descriptors: *Patents, *Waste water treatment, *Industrial wastes, *Proteins, *Sludge treatment, Coagulation, Agglomeration, Chemical reactions, Separation techniques, Heating, *Dewatering, Hydrogen ion concentration, *Chemical precipitation.

Identifiers: Precipitating agents.

The object of the invention is to condition proteinaceous sludges by addition of a suitable coagulating agent, so that heating of the sludge being conditioned in this manner yields a rapid and satisfactory coagulation and agglomeration of proteinaceous organic material, and the coagulated material can be removed by sedimentation, preferably in a centrifuge. The process provides a method for treating a proteinaceous sludge and comprises a chemical-thermal combination method yielding a concentrated proteinaceous sludge with a high content of solids simultaneously with the utilized precipitating agent going into solution in the separated aqueous phase and thus renders it possible to recover the precipitating agents. The conditioned sludge is mixed with calcium chloride, and treated with a base selected from the group consisting of alkali metal hydroxides and alkaline earth metal hydroxides to adjust the pH to a value in the range of 6.5-9.5. The mixture is then heated to a temperature in the range of 60 deg - 120 deg C. to coagulate and agglomerate the sludge, which is then separated from the aqueous phase containing the precipitating agent. (Sinha - OEIS)

W76-06478

SEWAGE TREATMENT APPARATUS,

J. Pacaud.
U.S. Patent No. 3,936,381, 4 p, 5 fig, 9 ref; Official Gazette of the United States Patent Office, Vol 943, No 1, p 338, February 3, 1976.

Descriptors: *Patents, *Waste water treatment, *Sewage treatment, *Domestic wastes, Water pollution treatment, Water pollution control, Water quality control, *Aeration, Turbulence, Water purification, Odor, Activated sludge, Application equipment.

The apparatus for the treatment of domestic sewage water is comprised of an outer tank and an inner tank which is placed within the outer tank to form a space between the vertical walls. The bottom of the inner tank is formed in such a way that light particles are prevented from ascending into the clarification tank. An aeration system provides a sufficient upwards suction of water for

WATER QUALITY MANAGEMENT AND PROTECTION—Field 5

Waste Treatment Processes—Group 5D

homogenizing, aerating and recirculating the sludges. The upper end of the clarification tank can be closed to permit trapping of fines of light particles in suspension which have been formed in the clarification tank. Nozzles slightly above the water level are provided for the evacuation of the light particles. A floating member protects the nozzles against the turmoil created by the aeration turbine. Treated or purified water is discharged through an outlet above the water level every time there is a new arrival of sewage water. (Sinha - OEIS)
W76-06481

EVAPORATION APPARATUS OF SPECIAL MATERIAL.
Hooker Chemicals and Plastics Corp., Niagara Falls, N.Y. (Assignee).
J. E. Houston.
U.S. Patent No. 3,937,646, 6 p, 1 fig, 11 ref; Official Gazette of the United States Patent Office, Vol 943, No. 2, p 812, February 10, 1976.

Descriptors: *Patents, *Water purification, *Alkali metals, *Industrial wastes, *Water quality control, Water pollution control, Water pollution treatment, *Evaporation, Heating, Separation techniques, *Evaporators, Heat exchangers.
Identifiers: Alkali metal hydroxides, Alkali metal chlorides, Ferritic stainless steel.

The invention provides an evaporation apparatus for use in the evaporation, concentration and purification of aqueous solutions containing alkali metal hydroxides and alkali metal chlorides, both with and without alkali metal chlorates. The apparatus has a liquid receiving chamber for the material to be processed, a flow through heating zone containing heat transfer elements, a separation chamber for forming a liquid-vapor mixture, passageways connecting the chambers and zones and baffle and distribution means positioned with the chambers, zones and passageways. Those surfaces of the chambers, zones, passageways, baffle and distribution means of the apparatus which are in contact with the solution of alkali metal hydroxide-alkali metal chloride material at temperatures in excess of about 50 deg C consist of a ferritic stainless steel. By the use of this material of construction, there is obtained an evaporation apparatus which may be successfully operated over a broad range of operating conditions and over extended periods of time without the necessity for being shut down for replacement of component parts due to corrosion and/or stress cracking, but which cost appreciably less than comparable apparatus fabricated from nickel. (Sinha - OEIS)
W76-06482

MARINE DISCHARGE CONTROL APPARATUS AND METHOD FOR TREATING FLUIDS ON A MARINE VESSEL.
Keene Corp., New York. (Assignee).
For primary bibliographic entry see Field 5G.
W76-06483

NEBRASKA NPDES PERMIT REGULATIONS.
For primary bibliographic entry see Field 5G.
W76-06495

NEVADA WATER POLLUTION CONTROL LAWS.
For primary bibliographic entry see Field 5G.
W76-06496

OREGON WATER QUALITY CONTROL REGULATIONS.
Oregon Dept. of Environmental Quality, Salem.
For primary bibliographic entry see Field 5G.
W76-06497

WISCONSIN WATER POLLUTION CONTROL LAWS.
For primary bibliographic entry see Field 5G.
W76-06498

WISCONSIN DISCHARGE PERMITS REGULATIONS.
For primary bibliographic entry see Field 5G.
W76-06499

OREGON SYNTHETIC CLEANSING AGENT ACT.
For primary bibliographic entry see Field 6E.
W76-06502

WASHINGTON WATER POLLUTION CONTROL LAWS.
For primary bibliographic entry see Field 5G.
W76-06504

WASHINGTON WASTE WORKS REGULATIONS.
For primary bibliographic entry see Field 5G.
W76-06507

WASHINGTON WATER POLLUTION CONTROL PLANNING REGULATIONS.
For primary bibliographic entry see Field 5G.
W76-06508

WASHINGTON NPDES PERMIT PROGRAM REGULATIONS.
For primary bibliographic entry see Field 5G.
W76-06510

SOAP AND DETERGENT MANUFACTURING CATEGORY (PRETREATMENT STANDARDS FOR INCOMPATIBLE POLLUTANTS).
Environmental Protection Agency, Washington, D. C.
For primary bibliographic entry see Field 5G.
W76-06517

EFFLUENT LIMITATIONS AND GUIDELINES - PRINTING INK FORMULATING POINT SOURCE CATEGORY.
Environmental Protection Agency, Washington, D. C.
For primary bibliographic entry see Field 5G.
W76-06520

NONFERROUS METALS MANUFACTURING POINT SOURCE CATEGORY.
Environmental Protection Agency, Washington, D. C.
For primary bibliographic entry see Field 5G.
W76-06521

PRELIMINARY ENGINEERING ANALYSIS, YUMA DESALTING PLANT.
Burns and Roe, Inc., Paramus, N. J.
For primary bibliographic entry see Field 3A.
W76-06547

CORRELATION OF RADIOACTIVE WASTE TREATMENT COSTS AND THE ENVIRONMENTAL IMPACT OF WASTE EFFLUENTS IN THE NUCLEAR FUEL CYCLE FOR USE IN ESTABLISHING 'AS LOW AS PRACTICABLE' GUIDES--APPENDIX A. PREPARATION OF COST ESTIMATES FOR VOLUME 1, MILLING OF URANIUM ORES.
Oak Ridge National Lab., Tenn.
A. D. Ryon, and R. E. Blanco.
Report No. ORNL TM-4903, Vol. 2, May 1975.
259 p. W-7405-eng-26.

Descriptors: *Waste treatment, *Industrial wastes, *Radioactive wastes, *Costs, Estimated costs, Dusts, Effluents, Solid wastes, Wyoming, New Mexico, Landfills, Operating costs, Capital costs, Facilities, Underground storage, Nuclear wastes.
Identifiers: *Uranium ore mills.

The methods used to estimate the capital and operating costs of alternate installations required for treating radioactive wastes at model uranium mills at Wyoming and New Mexico are detailed. Chemical and equipment requirements are based on model acid-leach solvent-extraction and for alkaline leach mills processing 2000 tons ore per day. Capital costs, in mid-1973 dollars, for treatment of solid and liquid mill effluents by the acid method range from \$284,000 to \$20,257,000; perating costs range from \$61,000 to \$4,809,000. Capital costs for the alkaline method range from \$279,000 to \$7,538,000 and operating costs vary from \$61,000 to \$6,302,000. Seven alternate treatment procedures for airborne emissions are described and represent \$88,000 to \$3,942,000 capital costs and \$10,800 to \$67,600 in operating costs. The annual fixed charge is 24% of the capital cost and the contribution to power cost is based on the total uranium oxide requirements of a power reactor over its life. The capital costs cover installation, piping, instruments, utilities, design, engineering, and construction, and a 40% allowance for interest during construction and for contingencies. The operating costs were computed by estimating labor, supplies, and maintenance requirements for the waste treatment processes applicable to the uranium milling industry and include a 15% allowance for contingency expenses. (Auen-Wisconsin).
W76-06614

REFINERY EFFLUENT WATER TREATMENT PLANT USING ACTIVATED CARBON.
Atlantic Richfield Co., Carson, Calif.
G. C. Loop.
Available from the National Technical Information Service, Springfield, Va., 22161, as PB-244 389, \$5.50 in paper copy, \$2.25 in microfiche. Report EPA-660/2-75-020, June 1975. 92 p, 30 fig, 10 tab. EPA 1BB036 12050 GTR.

Descriptors: *Activated carbon, Adsorption, Organic loading, Oxygen demand, Pollution abatement, Settling basins, *Waste water treatment, Carbon regeneration, *Chemical oxygen demand, Treatment facilities.
Identifiers: Intermittent carbon treatment plant, Calgon process.

Reduction of Chemical Oxygen Demand (COD) in petroleum refinery effluent wastewater by adsorption onto activated carbon was demonstrated on a commercial level during a two-year project at Carson, California. The plant contained over 750,000 pounds of carbon, regenerated 1,644,000 pounds of carbon, processed 172 million gallons of water, and removed 408,000 pounds of COD. The carbon was exhausted at the rate of 9.5 pounds per 1000 gallons of water processed. At an average feed COD concentration of 250 ppm and an average effluent COD concentration of 50 ppm, the carbon was loaded to an average of 0.26 pounds of COD per pound of carbon. Following solution of initial startup problems, the unit was operated at a cost of 40 cents per 1000 gallons of water treated, or 18 cents per pound of COD removed. (EPA)
W76-06646

AUTOMATIC ORGANIC MONITORING SYSTEM FOR STORM AND COMBINED SEWERS.
Raytheon Co., Portsmouth, R.I.
For primary bibliographic entry see Field 5A.
W76-06651

Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

Group 5D—Waste Treatment Processes

INFRARED DRY CAUSTIC VS. WET CAUSTIC PEELING OF WHITE POTATOES,
Western Potato Service, Inc., Grand Forks, N. Dak.

O. Sproul, J. Vennes, W. Knudson, and J. W. Cyr. Available from the National Technical Information Service, Springfield, Va. 22161, as PB-244 408, \$4.50 in paper copy, \$2.25 in microfiche. Report EPA-660/2-74-088. June 1975. 64 p, 12 fig, 26 tab, 11 ref. 12060 EIG. EPA 1BB037.

Descriptors: Environmental engineering, *Food processing industry, Potatoes, *Industrial wastes, *Waste treatment, *Waste water treatment.
Identifiers: *Potato processing wastes, *Infrared dry caustic system, *Wet caustic system.

The infrared dry caustic peeling system has been evaluated through plant scale comparisons with the conventional wet caustic system. The following significant differences were noted when the dry peel system was compared to the wet process: (a) decreased peel loss by 13.1 percent. (b) decreased caustic consumption by 26 percent. (c) decreased wastewater from peeling by 73 percent. (d) decreased BOD5 in the peeler wastewater by 78 percent. (e) decreased suspended solids in the peeler wastewater by 77 percent. (f) decreased alkalinity in the peeler wastewater by 61 percent. (g) increased operating costs of peeling by 39 percent but decreased total annual cost of peeling and primary treatment through lower peel loss by 10 percent. (h) decreased total plant raw waste load: water use by 18 percent, BOD5 by 47 percent, and suspended solids by 57 percent. No significant differences were noted in the efficiency of primary sedimentation of the raw wastes nor in the mud clarifier results. Primary sludges and their de-watering characteristics were similar. (EPA) W76-06652

WATER POLLUTION ABATEMENT THROUGH FOREST IRRIGATION WITH MUNICIPAL WASTE WATER,

Pennsylvania State Univ., University Park. Inst. for Research on Land and Water Resources. W. E. Sopper.

In: Groundwater Pollution - Symposium (Proceedings of the Moscow Symposium) August 1971. 17 p, 10 tab, 11 ref. IAHS-AISH Publication No. 103, 1975. OWRP B-001-PA(9), B-047-PA(5). 14-31-0001-3639. 14-01-0001-837.

Descriptors: *Waste water treatment, *Waste water disposal, Pollution abatement, Surface waters, Recharge groundwater, Groundwater reservoirs, Environmental sanitation, Disposal, Abatement, Crop production.
Identifiers: *Forest irrigation, *Municipal wastewater, *Land disposal, Wood fibre increase.

Serious pollution problems are often created by the disposal of municipal waste water into surface waters. An obvious alternative method is diversion of these waste waters to the land. Such non-aqueous methods of disposal might eliminate or alleviate many water pollution problems and, in some cases, could even provide secondary benefits such as recharge of groundwater reservoirs, and increased production of crops and wood fibre. Research results during the past 8 years from the Pennsylvania State University Waste Water Renovation and Conservation project indicate that large volumes of municipal waste water can be successfully disposed of through irrigation of forest land. With properly programmed application rates, waste water can be satisfactorily renovated and considerable amounts of high-quality water recharged to the groundwater reservoir. In addition, secondary benefits such as increased tree growth, increased site productivity, and site amelioration have also been obtained. The deliberate reclamation of waste water for potential reuse is one of the keys to optimum utilization of water resources. (Sink-Penn State) W76-06668

URBAN EFFECTS ON THE DISTRIBUTION OF HEAVY CONVECTIVE RAINFALL,
Illinois State Water Survey, Urbana.
For primary bibliographic entry see Field 4C. W76-06680

YBBARPSAN-A SMALL RECEPTACLE FOR A LARGE INDUSTRY: WATER CONSERVATION ACTION IN THE VICINITY OF PERSTORP AB, (IN SWEDISH),
I. Borgstrom, and G. Grankvist.
Vatten 29(4), p 418-428, 1973.

Descriptors: Water conservation, Europe, *Activated sludge, *Waste water treatment, *Treatment facilities, Biochemical oxygen demand, Organic wastes, Water reuse, Industrial wastes.
Identifiers: Ybbarpsan.

The steps taken by Perstorp AB, a chemical and plastics manufacturing firm in Sweden, to eliminate pollution from its wastewater are discussed. A wastewater treatment plant based on activated sludge process was constructed. The plant is constructed for an addition of 3000 kg BOD7 (biological oxygen demand) a day. The wastewater to be treated contains mainly aldehydes, alcohols, organic acids and their salts. The efficiency of BOD7-reduction is about 90%. Experiences for 2 yr of plant operation are presented.—Copyright 1975, Biological Abstracts, Inc. W76-06732

TREATMENT PLANTS FOR REMOVING HELMINTHS FROM SEWAGE BEFORE ITS USE ON CULTIVATED PASTURES, (IN RUSSIAN),
All-Union Scientific Research Inst. of Medical Parasitology and Tropical Diseases, Moscow (USSR).

N. A. Romanenko, F. S. Marenkin, Z. M. Smirnova, and L. F. Rakhvalova.
Gig Sanit 11, p 80-81, 1974.

Descriptors: *Waste water treatment, Waste disposal, *Sewage treatment.
Identifiers: *Helminths eggs removal.

In the treatment method developed, the sewage is first held for 2 h in settling tanks, then it passes to filtration fields, and then to a storage pond where it is held for at least 20-30 days. After this the sewage is collected for irrigation of cultivated pastures. This method provided complete and reliable removal of helminth eggs from sewage.—Copyright 1975, Biological Abstracts, Inc. W76-06795

5E. Ultimate Disposal Of Wastes

MARINE POLLUTION CONTROL: PART III-SHIP DESIGN REQUIREMENTS: THE DESIGN APPROACH,

Naval Ship Engineering Center, Hyattsville, Md. Environmental Pollution Control Branch.
For primary bibliographic entry see Field 5D. W76-06196

UTILIZATION OF ANIMAL MANURES AND SEWAGE SLUDGES IN FOOD AND FIBER PRODUCTION,

Iowa State Univ. of Science and Technology, Ames. Council for Agricultural Science.
For primary bibliographic entry see Field 5D. W76-06198

PHILADELPHIA'S SOLID WASTES STRATEGY STRESSES PRIVATE SECTOR PARTICIPATION,
Philadelphia Dept. of Streets, Pa.
D. J. Damiano.

Refuse Removal Journal, Solid Wastes Management, Oct. 1975, Vol 18, No. 10, p 40, 50-52, 53.

Descriptors: *Management, *Solid wastes, *Waste disposal, *Municipal wastes, *Pennsylvania, Land reclamation, Long-term planning, Economics, Railroads, Strip mines, Financing, Energy conversion, Incineration, Recycling.
Identifiers: *Philadelphia(Pa), Demonstration projects.

The strategy adopted by Philadelphia for handling urban solid wastes is described. Alternatives to local and New Jersey landfills were needed, thus a plan was conceived to rail haul solid wastes for reclamation of abandoned strip mines. After examining alternatives, use of private business, rather than government, appeared advisable. Bidders' qualifications were the ability to remove up to 1000 tons waste/day to remote disposal sites subject to rigid ancillary requirements. A public/private financing system was devised. An energy recovery feasibility study recommended a new 1600 ton/day thermal conversion facility, upgrading of continuous-feed incinerators, and conversion of four batch-fed incinerators to transfer stations. With other components of the city's disposal system, 15,000 tons refuse/week could be handled. The plan is being evaluated and financing is being studied. Another study is being conducted on the marketability of energy and materials recovered from municipal refuse. After examining various alternatives, Philadelphia is using the legal, financial, and managerial capabilities of the private sector. The emergence of private, stockholder-owned companies in the municipal refuse field is a new development and a segment of innovative, long-range planning. (Buchanan-Davidson--Wisconsin) W76-06199

TWO MILLION YARDS OF BURIED REFUSE MOVED.

Refuse Removal Journal, Solid Wastes Management, p. 10-12, October 1975.

Descriptors: *Relocation, *Landfills, Sites, *New York, Compaction, Estimated costs, Barges, Excavation, Transportation, Pollution abatement, Odor.
Identifiers: *Landfill relocation, Buffalo(NY), Odor control.

In 1973 the Sewer Authority of Buffalo, New York, decided to build a secondary wastewater treatment plant on a 20-year-old landfill site containing over 2 million cubic yards of compacted refuse. It was decided to move the material by barge to a site miles away. Estimated costs were about \$10,250,000. An impervious barrier was built around the perimeter and a leachate collection system installed to prevent waste liquid escape at the new site. Refuse excavation was done with specially equipped dozers. A clamshell crane lifted out large items which might clog the conveyor. The refuse was carried by conveyor to the river where barges transferred about 20,000 tons a day. Care was taken to avoid spillage where the conveyor crossed a service road. The main environmental problem was odor. When crossing the service road, refuse was wetted down with Odaban odor modifier in the winter; in the summer, a Chemscreen odor modification system formed an odorabating vapor. Tarpaulins covered barges and dump trucks were used to carry refuse to the new site to prevent blowing trash. Refuse was spread, compacted, covered with soil, and seeded with fescue and bluegrass, thus creating a new park. (Buchanan-Davidson--Wisconsin) W76-06223

EFFICIENT IN-HOUSE HANDLING OF SOLID WASTE,
R. A. Young.
Pollution Engineering, Vol. 7, No. 1, p. 43-45, 1975. 1 fig.

Descriptors: *Solid wastes, *Waste disposal, Incineration, Automation, Equipment, Costs, Economic efficiency, Waste treatment.
Identifiers: In-house waste collection, Commercial wastes, Warehouses, Hospitals, Conveyor systems.

Refuse collection and transport to disposal areas usually accounts for more than 75% of solid waste management costs. Handling wastes by automated methods can improve efficiency of refuse disposal and reduce costs. Bamberger's Distribution Center, Raritan Center, New Jersey, generates an estimated 18,000 cubic yards of waste per year in their warehouse. It uses a towcart system to move supplies and remove solid wastes to an incinerator. Trash carts are located where refuse is generated. Bamberger's Department Store, Langhorne, Pennsylvania, creates about 600 cubic yards uncompact waste monthly. A storewide conveyor system leads to an automatic shredder and compactor which continuously supplies waste to an incinerator through a drop chute. Cost was about \$100,000. Alachua Hospital, Gainesville, Florida, has a dual pneumatic tube system. The same air stream moves trash to the incinerator or laundry to the laundry room. Trash accumulates in a hopper until the desired weight, then is emptied by an attendant into an incinerator; this last operation is being automated. The type and amount of solid waste will determine what type of mechanized equipment is required and if savings are possible over manual methods. (Buchanan-Davidson-Wisconsin)
W76-06224

DEVELOPER'S PLANS DETAIL TRASH COLLECTION SYSTEM.

Refuse Removal Journal, Solid Wastes Management, Vol. 18, No. 1, p. 20, 22, 58, 1975.

Descriptors: *Municipal wastes, *Sanitary engineering, *Solid wastes, *New Jersey, Costs, Contracts, Compaction, Equipment, Recycling.
Identifiers: *Waste collection, Shopping centers, East Brunswick(NJ), New Brunswick(NJ), South Amboy(NJ), Paper recycling(NJ), Commercial wastes.

The trash collection system at the Brunswick Square Mall, East Brunswick, New Jersey, is the Cobey Refuse Handling System. All, except two stores which have their own waste pickup contracts, compact their waste in individual compactors. Waste from each store is metered. Stores must comply with strict standards for handling waste. Compacted material is removed to a nearby landfill site by Jersey Sanitation, Inc. This firm also handles residential collections for New Brunswick, East Brunswick, and South Amboy. The contracts require pick up of all residential trash at a fixed overall fee, thus imposing economic efficiency. Because some alleys are small, pickup trucks haul trash to the street, where it is transferred to rear loading trucks. About 10,000 people are served with a pickup truck and a two-man crew. Private two-way radios link trucks and foremen who oversee the residential pickups. The areas served are small and close to landfill sites. The company is also experimenting with paper recycling. Garden apartment complexes are being encouraged to segregate paper and shopping malls are encouraged to keep corrugated materials out of the compactor. (Buchanan-Davidson-Wisconsin)
W76-06225

CONVERSION OF DESALINATION PLANT BRINES TO SOLIDS.

Badger (W. L.) Associates, Inc., Ann Arbor, Mich.
For primary bibliographic entry see Field 3A.
W76-06248

USING WASTEWATER SOLIDS TO RECLAIM STRIP-MINED LAND.

Metropolitan Sanitary District of Greater Chicago, Ill.

For primary bibliographic entry see Field 5G.
W76-06287

CAERNARFON SLUDGE GOES UP IN SMOKE.

M. C. Bailey, and J. G. Palmer.
Surveyor, Vol. 146, No. 4355, p 18-21, November, 1975. 2 fig.

Descriptors: *Incineration, *Sludge treatment, *Dewatering, *Sludge disposal, Centrifugation, Odor, Sulfur, Sewage treatment, Treatment facilities, Design.
Identifiers: Fluidized bed reactor.

A fluidized bed reactor was chosen for the new incineration plant being installed in the tourist town of Caernarfon, United Kingdom. Incineration was chosen over other sludge disposal methods because it takes place at the treatment plant site and it is odorless. Disposal of sludge as fertilizer was not suited to the grazing land around the town, and drying the sludge in open beds is not practical due to the average 60 inches of rainfall each year. The Caernarfon sludge will not be dry enough to be autothermic, so supplementary fuel oil will be necessary. To remove the sulfur from the gas emissions produced not only by the sludge waste but also by the fuel oil, a dry gas cleansing system with limestone or dolomite will be annexed to the incinerator. Particulate matter and heat will be recovered in a heat exchanger. Since the incinerator requires preliminary dewatering of the sludge, centrifuging was selected as the most economical and the simplest dewatering method. A feature of the centrifuge is the 100% standby capacity that insures that the incinerator will never be out of action if the dewatering plant fails. The total sewage treatment works were designed to cope with flows from a population of 12,500 but can be expanded to handle flows from a population twice that size. The treatment plant construction is completed and the incinerator is scheduled to be completed by March, 1976. (Loustau-FIRL)
W76-06291

SLUDGE DISPOSAL ALTERNATIVES.

Camp, Dresser and McKee, Inc., Boston, Mass.
A. A. Kalinski, A. B. Pincince, M. H. Klegerman, and T. F. X. Flynn.
Water and Sewage Works, Vol. 122, No. 11, p 61, November, 1975.

Descriptors: *Incineration, *Burning, *Sludge disposal, *Costs, Fertilizer, Energy, Sludge treatment.
Identifiers: *Pyrolysis.

Incineration or pyrolysis was found to be the most cost-effective, technically feasible, and environmentally acceptable method for disposing sludge, according to the results of a study funded by the EPA for the New York-New Jersey area. The study took into consideration that the present sludge production of 600 tons/day may expand to 2000 tons/day by the year 2000. It was assumed, based on present values, that the volatile solid content would be about 50% of the total, and the fuel value of the total solids would be approximately 5,000 Btu/lb. An average value of 4% solids was assumed. The choice of incineration as the best method was made in comparison with disposal of either liquid digested sludge or dewatered sludge cake on a strip mine area 100 miles from the study area. In this comparison, the total cost of disposal was over double the net cost for incineration or pyrolysis. The possibility of producing a commercial fertilizer from the sludge was not even comparable to incineration due to the high expense of fertilizer production. The incineration process includes sludge conditioning with chemicals and use of filter pressing to obtain a 40% solids sludge cake. During normal operation, the system for incineration or pyrolysis will consume no auxiliary fuel, except if afterburning is required, and the energy recovery will supply all electrical requirements of the sludge processing

facility. Moreover, there will be a significant amount available for other uses. (Loustau-FIRL)
W76-06292

HORIZONTAL SPREAD OF WASTEWATER FIELD OVER CALM OCEAN SURFACE.

Montgomery (James M.), Pasadena, Calif.
For primary bibliographic entry see Field 5B.
W76-06294

EVIDENCE FOR NEW ALUMINUM PHOSPHATE PHASE FROM REACTION RATE OF PHOSPHATE WITH ALUMINUM HYDROXIDE.

Agricultural Univ., Wageningen (Netherlands). Dept. of Soils and Fertilizers.
W. H. Van Riemsdijk, F. A. Weststrate, and G. H. Bolt.
Nature, Vol. 257, No. 5527, p 473-474, October 9, 1975. 2 fig, 1 tab, 8 ref.

Descriptors: *Phosphates, *Nutrient removal, Kinetics, Waste water disposal, Aluminum, Chemical precipitation, Soils, Sewage disposal, Pollutant identification, Analytical techniques.
Identifiers: Aluminum phosphate, Sterrettite.

In systems where waste water is disposed directly onto the soil, the reaction between phosphate and aluminum hydroxide is an important one. It has been suggested that the precipitation of phosphate occurs when raw sewage water is applied to sandy topsoil for an extended period of time. The presence of an aluminum phosphate has been indicated as the main fraction of phosphate retained. Experiments on this precipitation reaction were performed at 20.5 ± 0.1 C with an initial phosphate concentration of 0.36 mmol/cu dm at a pH of 5. Results of the measurements are presented in a semi log plot of the measured phosphate concentration as a function of reaction time for a suspension concentration of 0.2 g/cu dm Al(OH)₃. An increase in reaction rate on the graph was hypothesized to be due to the initiation of the growth of a crystalline aluminum phosphate. This supposition was tested using electron microscopy, electron diffraction, and X-ray diffraction. From the results, crystalline structures with a measured value agreeing with those of sterrettite were found. Evidence indicated that the growth of an aluminum phosphate phase was the rate determining step after a particular point on the graph. (Kramer-FIRL)
W76-06295

SIGNIFICANCE OF TRACE METALS AND NITRATES IN SLUDGE SOILS.

Environmental Protection Agency, Columbus, Ohio. Div. of Waste Management and Engineering.

R. E. Brown.
Journal Water Pollution Control Federation, Vol. 47, No. 12, p 2863-2875, December, 1975. 3 fig, 7 tab, 39 ref.

Descriptors: *Trace elements, *Soil analysis, *Heavy metals, *Zinc, Toxicity, Sludge disposal, Fertilization, Metals, Nitrates, Environmental effects.
Identifiers: Land application.

There is substantial potential for damage to the productivity of soils that are fertilized with waste water sludge, if no restrictions are made on the metal and nitrogen accumulations in the soil. A comparison of sludge-amended soils and soils that received no sludge showed that extractable zinc increased many times in sludge-amended soils. In addition, almost all of the applied zinc remained in an extractable form, thus presumably more available for plant uptake than metals in soils that have not received sludge. One report attributed crop damage in 24 cases to application of sludge. Another report showed that sludge applications that increased zinc by approximately 340 lb/acre

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produced no metal toxicity in corn grown on the site. Although data are not available to evaluate long-term effects of metals in sludge, it is generally agreed that, on a short-term basis, the addition of metal salts to soils without sludge would be more likely to cause metal toxicity conditions in plants than would an equivalent amount of metal from waste water sludge. Concerning nitrate pollution, there is no question of the fact that nitrate content of drainage waters from a sludge disposal site would be excessively high if no restrictions were placed on application. Dilution of the drainage water by groundwater or receiving water could minimize the hazard. In the case of sludge application to crop soils, the nitrogen application must equal the sum of gaseous nitrogen losses and the nitrogen requirement of the crop. Any excess would become a hazard in leachate groundwater. Because of the many variables, amounts of nitrogenous sludge applicable to soils should be determined on a site-by-site basis. (Loustau-FIRL)
W76-06307

HYDROLOGICAL AND HYDROGEOLOGICAL ASSESSMENT OF LANDFILL SITES,
R. Aspinwall.
Solid Wastes, Vol. 65, No. 8, p 390-403, August, 1975.

Descriptors: *Solid wastes, *Landfill, *Waste disposal, Rainfall, Drainage, Public health, Soil chemical properties, Soil physical properties, Aquifers, Environmental effects, Aquifers.

The variables of a solid waste disposal pit are the amount of rainfall, the overall catchment area of the pit, the actual top of the excavation, the volume of waste going into the pit, and the catchment area which must be controlled by artificial drainage works. If a pit is lined with impervious clay, the leachates will not seep away and the pit will fill up with water not only from rainfall but also from liquid wastes that have no other disposal system available. In England it was estimated that there are some 500 million gallons of liquid waste produced annually that are unacceptable for incineration or mineshaft disposal and are probably being dumped anywhere space can be found. For pit disposal in the present clay lined type, a conservative estimate of 30-acre pits needed for waste disposal would be 12 new pits a year. In addition, this solution of waste disposal produces water pollution and health hazards. A new model of landfill site has been proposed: a permeable earth medium on top of a permanent saturation. The chemical properties of the earth, especially with some clay present, would remove heavy metals and degrade the leachate. At the saturate zone the leachate would be diluted with existing groundwater and travel a long distance to a safe discharge point in the sea or a river. Such a site would be considered an aquifer and an important national asset as a water storage and collection site. Local water authorities might object to the idea, but the need for safe waste disposal must be weighed against the loss of some aquifers. (Loustau-FIRL)
W76-06315

STAGONOSPORA FOLICOLA, A PATHOGEN OF REED CANARYGRASS SPRAY-IRRIGATED WITH MUNICIPAL SEWAGE EFFLUENT,
Agricultural Research Service, University Park, Pa. Regional Pasture Research Lab.
K. E. Zeiders.
Plant Disease Reporter, Vol. 59, No. 10, p 779-783, October, 1975. 1 fig, 1 tab, 10 ref.

Descriptors: *Sewage effluents, *Irrigation, *Waste disposal, Waste water(Pollution), Water pollution effects, Fungi, Plant pathology.
Identifiers: Leaf disease, Reed canarygrass, Stagonospora folicola.

A field of reed canarygrass (Common) which was spray irrigated with municipal sewage effluent was

found to have a foliar disease resembling tawny blotch. Adjacent fields of reed canarygrass with no irrigation had no disease. This occurrence prompted an investigation of the etiology of the disease and studies of the pathogen. The causal fungus, taken from infected reed canarygrass, was isolated from diseased tissue and identified as *S. folicola*. Two tests were then made to determine conditions favorable for infection and disease development. Potted ramets of Common reed canarygrass from the irrigated field were inoculated by spraying with a conidial/mycelial suspension of *S. folicola* until thoroughly wet. In the first test plants were kept in various combinations of chamber, temperature, and exposure periods, and it was found that disease development was better in plants kept 72 hours in a dew chamber. In the second test, time-of-exposure in a dew chamber was varied, and again disease development was better in plants given a 72-hour incubation period. Of eight species inoculated, only one, *P. arundinacea*, was susceptible to the disease. These studies indicated that the build-up of tawny blotch on reed canarygrass will be favored by two factors: plants remaining uncut throughout the growing season so that more leaves are exposed to inoculum of the fungus for a prolonged period of time, and periods of three days of cool weather and abundant moisture for infection and disease development to be initiated. The effect of the plant nutrients in the effluent water on disease development was not known because there were no areas irrigated with "pure" water for comparison. (Loustau-FIRL)
W76-06318

A FRAMEWORK FOR EVALUATING INSTITUTIONAL AND SOCIO-ECONOMIC ISSUES OF LAND TREATMENT OF WASTE WATER,
Economic Research Service, Upper Darby, Pa. Natural Resource Economics Div.
For primary bibliographic entry see Field 5G.
W76-06320

EFFECT OF SEWAGE SLUDGE ON SOME SOIL PHYSICAL PROPERTIES,
Agricultural Research Service, Beltsville, Md. Agricultural Environmental Quality Inst.
E. Epstein.
Journal of Environmental Quality, Vol. 4, No. 1, p 139-142, January/March, 1975. 7 fig, 2 tab, 10 ref.

Descriptors: *Sludge disposal, *Sewage sludge, *Soil physical properties, Soil water, Waste disposal, Hydraulic conductivity.
Identifiers: *Land application.

The effect sewage sludge application to soil has on soil water retention, hydraulic conductivity, and aggregate stability at 15, 25, and 35 C for 175 days, was determined by weight measurement and the presence of pH and carbon. Raw sludge retained twice the amount of water retained by digested sludge. The two digested sludge treatments (high and low pH) retained approximately 10 times more water than the soil control. With higher temperatures, available water decreased with time and reached equilibrium faster, suggesting that the changes in water retention were related to microbial activity. However, the total carbon contents of the soil-sludge mixtures did not change greatly. Although hydraulic conductivity varied among sludge soil samples initially, after 79 days the hydraulic conductivity was essentially the same. The percent stable aggregates for sludge treatments after 175 days were essentially the same, averaging 34%, compared to 17% in untreated soil control. Temperature had little effect on aggregate stability. This information could affect decisions on disposal of municipal wastes. Rather than dumping sludge into landfills or the ocean, or burning sludge in incinerators, sludge could be added to soil, producing greater soil stability, water infiltration, and water movement. (Loustau-FIRL)
W76-06331

USE OF SEWAGE SLUDGE ON AGRICULTURAL LAND AND THE EFFECTS OF METALS ON CROPS,
Agricultural Development and Advisory Service, Wolverhampton (England).
For primary bibliographic entry see Field 5C.
W76-06339

ZERO DISCHARGE TO THE ENVIRONMENT OF DIFFICULT WASTEWATERS,
For primary bibliographic entry see Field 5D.
W76-06341

REVEGETATING BITUMINOUS STRIP-MINE SPOILS WITH MUNICIPAL WASTEWATER, PART II: QUALITY THE LEACHATE AND SPOIL CHEMICAL CHANGES,
Pennsylvania State Univ., University Park. Dept. of Forest Hydrology.
For primary bibliographic entry see Field 5D.
W76-06343

LAND DISPOSAL OF SEWAGE SLUDGE, VOLUME I (NOVEMBER 1972 - MARCH 1973),
Guelph Univ. (Ontario).
Canada-Ontario Agreement on Great Lakes Water Quality, Research Report No. 16, Environment Canada, Ottawa, Canada, Training and Technology Transfer Division (Water), Environmental Protection Service, 1972. 39 p, 3 fig, 16 tab, 8 ref.

Descriptors: *Waste water disposal, *Sewage disposal, *Agriculture, Nutrients, Heavy metals, Leaching, Erosion, Soils, Lime, Runoff, Nitrogen, Water quality, Groundwater, Pollutants, Microorganisms, Coliforms, Bacteria, Hydrogen concentration, Groundwater movement, *Sewage sludge.
Identifiers: *Chemically-treated sludge, Nitrogen transformation, Aluminum sulphate, Ferric chloride, Phosphorus removal.

This study was designed as the first part of a three to five year project to determine the rates at which chemically treated sewage sludges may be safely applied to agricultural land. Initial experiments with sludges resulting from sewage treated with lime, aluminum sulphate, and ferric chloride are described. The sludges were applied to three different soils at rates based on the total nitrogen content of each sludge. The following aspects of sludge application to soil were investigated: rate of nitrogen transformation to soluble forms when chemical sludges are incorporated into sand - soil mixtures; bacterial contamination of runoff and groundwater; the macromorphology, micromorphology, and the chemical and physical states of the soil prior to application; the effect of sludges on plant growth; and nutrient and heavy metal uptake by plants. (Environment Canada)
W76-06365

WASTEWATER DISPOSAL BY SUBMERGED MANIFOLDS,
Miljøplan, Hovik (Norway). Water Pollution Section.
For primary bibliographic entry see Field 5B.
W76-06387

LOW DRIFT SPRAY NOZZLE,
Delavan Manufacturing Corp., West Des Moines, Iowa. (Assignee)
For primary bibliographic entry see Field 5G.
W76-06467

USE OF SILVER AND ZINC TO TRACE SEWAGE SLUDGE DISPERSAL IN COASTAL WATERS,
Delaware Univ., Newark. Coll. of Marine Studies.
For primary bibliographic entry see Field 5B.
W76-06655

BUFFALO HARBOR DIKED DISPOSAL SITES: ENGINEERING PROPERTIES AND DRAINAGE CHARACTERISTICS, State Univ. of New York Coll. at Buffalo. D. L. Wright, and R. R. Rumer, Jr. NYSSGP-SS-75-028, December 1975. 12 p, 3 fig, 1 tab, 3 ref, append.

Descriptors: *Harbors, *Sewage disposal, *Dikes, *Drainage, Landfills, Coastal engineering, Engineering structures, Sanitary engineering, New York, Lake Erie. Identifiers: *Buffalo harbor(NY), *Diked disposal sites, Slag dikes, Fill material, Drainage networks.

The objective was to determine the engineering properties of the placed fill material and the drainage characteristics of diked disposal sites in the Buffalo harbor area. The hydraulic conductivity of the dredged material and the dikes along with the drainage characteristics of the disposal sites constituted the major focus of the hydraulic study. The engineering properties studied were the consolidation characteristics, bearing capacity, and slope stability of the placed fill. Slag dikes were found to be structurally sound and allowed rapid drainage. The fill material is spongy and not able to maintain slopes; it will not support buildings or roads unless piles are driven or extra underpinnings constructed first. The fill material does not drain well. A drainage network on the surface, with shallow channels sloping gently toward the dikes, would improve matters. (NOAA) W76-06666

SEWAGE SLUDGE AND AMMONIUM CONCENTRATIONS IN THE NEW YORK BIGHT APEX, State Univ. of New York at Stony Brook. Marine Sciences Research Center. For primary bibliographic entry see Field 5B. W76-06667

WATER POLLUTION ABATEMENT THROUGH FOREST IRRIGATION WITH MUNICIPAL WASTE WATER, Pennsylvania State Univ., University Park. Inst. for Research on Land and Water Resources. For primary bibliographic entry see Field 5D. W76-06668

EVALUATION OF MILL TAILINGS DISPOSAL PRACTICES AND POTENTIAL DAM STABILITY PROBLEMS IN SOUTHWESTERN UNITED STATES, INVESTIGATION REPORT, PHELPS DODGE CORPORATION, MORENCI TAILINGS DAM, MORENCI, ARIZONA, VOLUME 2, Wahler (W. A.) and Associates, Palo Alto, Calif. For primary bibliographic entry see Field 5G. W76-06669

EVALUATION OF MILL TAILINGS DISPOSAL PRACTICES AND POTENTIAL DAM STABILITY PROBLEMS IN SOUTHWESTERN UNITED STATES, INVESTIGATION REPORT, KENECOTT COPPER CORPORATION, MAGNA TAILINGS DAM, MAGNA, UTAH, VOLUME 3, Wahler (W. A.) and Associates, Palo Alto, Calif. For primary bibliographic entry see Field 5G. W76-06670

EVALUATION OF MILL TAILINGS DISPOSAL PRACTICES AND POTENTIAL DAM STABILITY PROBLEMS IN SOUTHWESTERN UNITED STATES, RECONNAISSANCE REPORT, VOLUME 5, Wahler (W. A.) and Associates, Palo Alto, Calif. For primary bibliographic entry see Field 5G. W76-06672

INCINERATION AT SEA OF LIQUID CHLORINATED RESIDUES (IN FRENCH), Centre d'Etude et de Recherches de Biologie et d'Océanographie Médicale, Nice (France). J. P. Breittmayer, G. Flatau, M. Barelli, F. Laumond, and D. Puel. Rev Int Oceanogr Med 39/40, p 213-224, 1975.

Descriptors: *Incineration, Organic wastes, Waste disposal, Organic compounds, Liquid wastes, Toxicity, Food chains, Industrial wastes, Ultimate disposal. Identifiers: *Organochlorinated compounds.

Intensive industrial use of organochlorinated compounds produces large amounts of highly toxic wastes. Open sea burning may be an effective disposal method, avoiding pollution of the marine environment. While the direct toxicity of these products on each level of a trophodynamic marine food chain is very high, direct or induced toxicity of the vapor phase of the combustion along the same marine food chain was not evident.—Copy-right 1975, Biological Abstracts, Inc. W76-06746

5F. Water Treatment and Quality Alteration

ANNUAL DEVELOPMENT OF PLANKTON IN A RIVER WATER INTAKE WEIR AND IN A TREATMENT POND AND ITS REMOVAL IN TREATMENT PLANTS, Instytut Kształtowania Środowiska, Warsaw (Poland). Zakład Użytkowania i Ochrony Wod. For primary bibliographic entry see Field 5C. W76-06211

THE USE OF CHITOSAN COLUMNS FOR THE REMOVAL OF MERCURY FROM WATERS, Ancona Univ. (Italy). Faculty of Medicines and Ancona Univ. (Italy). Chemistry Lab. For primary bibliographic entry see Field 5A. W76-06239

MODERNIZING WATER FILTRATION PLANTS, Riddle Engineering, Inc., Kansas City, Mo. W. G. Riddle. Public Works, Vol. 105, No. 6, p. 86-88, 108, June, 1974. 4 fig, 5 ref.

Descriptors: *Filtration, *Water purification, *Water treatment, *Filters, *Coagulation, Flocculation, Water quality control, Turbidity, Polyelectrolytes. Identifiers: Turbidimeters.

Capacity of a well designed and maintained old water plant may be increased by modifying piping, basins, supporting elements, and upgrading the filter. The traditional 2 gallon per minute per square foot filtration rate can be multiplied several times, but high-rate filters must satisfy certain critical parameters. The modern 4 to 8 gallon per minute filter incorporates some but usually not all of the following: a dual bed involving two or more layers of graduated materials; wash rates of up to one and a half times traditional designs; air wash; strainer type filter bottom; secondary coagulant consisting of flocc-strengthening polyelectrolyte; a pilot filter; and photoelectric turbidimeters to monitor raw water. Improved coagulation is necessary for high speed filtering so that today a comparatively violent flash mix, mechanical stirring in the flocculator basin, and improved instrumentation are called for. The addition of 10 to 30 parts per billion of polyelectrolyte to the settled water above the filter strengthens the floc which allows it to penetrate deeper into the bed, resulting in a greater use of storage capacity. A pilot filter can detect deterioration of coagulation early so that normal conditions can be restored quickly. Similarly a pilot filter effluent turbidimeter per-

mits adjustments to be made in primary coagulant feed rate and start up of the polymer feeder to the settled water at the filter effluent. Turbidimeters are efficient to operate, the only criticism being in calibration in ranges below .3 Jackson turbidity units. Backwash is an essential part of the system to permit trouble-free operation at high speed. (Smith-North Carolina) W76-06275

PIONEERING IN WATER FILTRATION, Whitman and Howard, Inc., Boston, Mass. S. Medlar. The American City, Vol. 90, No. 6, p 90-93, June 1975. 6 fig.

Descriptors: *Water supply, *Water treatment, *Filtration, *Water quality control, *Treatment facilities, *Activated carbon, Water pollution control, Water pollution treatment, Pesticide removal, *New Hampshire. Identifiers: Manchester(NH), Double filtration process, Granular activated carbon(GAR), Lake Messabesic(NH), Merrimack River(NH).

Manchester, N.H. (population 88,000) constructed a \$5.9 million treatment plant designed around a double filtration process which removes natural impurities and hazardous chemicals. The 40 million gallon a day facility will promote economic and residential expansion. Abandoning the polluted Lake Massabesic, Manchester will use the Merrimack River as its future source of water. The plant, able to treat either lake or river water, operates with a 5-step process: removal of particulate and dissolved impurities, flash mixing, flocculation and sedimentation, and double filtration with sand and deep-bed granular activated carbon (GAC) filters. This process results in elimination or reduction of color, taste, odor, turbidity, pesticides, volatile organics, phenols, herbicides, gasoline, iron, corrosiveness and toxic chemicals. Construction and operation costs are estimated at \$1.40 a year per customer. Advantages of double filtration include increase in carbon adsorption and removal of oxidized iron, low particulate loading reducing backwashing to a minimum, tolerance of a softer granular carbon, ability to function under emergency conditions and savings in power. (Salzman - North Carolina) W76-06278

PROBLEM OF SELECTING INDICES FOR THE RELIABILITY OF WATER SUPPLY AND SEWER NETWORKS, PART I (ZACADNIENIE WYBORU WSKAZNIKOW NIEZAWODNOSCI SYSTEMOW WODOCIAGOWYCH I KANALIZACYJNYCH. CZESC I), H. Kloss, and M. Rowan. Gaz. Woda i Technika Sanitarna, Vol. 49, No. 10, p 305-307, October, 1975. 1 fig.

Descriptors: *Model studies, *Water supply, Economics, Repairing, Equipment, Design criteria, Mathematical models, Networks, *Sewers. Identifiers: *Poland.

Definitions and models of reliable and efficient water supply systems and their elements were discussed. Supplying data on the over-all and precise workings of technical objects from an economic viewpoint, the Central Bureau of Standards in Warsaw, Poland, furnished the indicators of reliability properties. According to the Bureau, all technical objects could be divided into repairable and irreparable categories. The definition of the former was an object which could be repaired for damages, and the definition of the latter was an object for which no repairs could be anticipated, even in the event of reversible damage. The category in which the object under discussion will be included is often decided by the user. In accordance with Soviet standards, reliability of an object is evaluated by the total number of such properties as suitability, durability, reparability,

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resistance to storage, and preservation of inherent functional properties. The Central Bureau of Standards elaborated on these definitions. On their basis of the properties indicated, a number of mathematical equations were developed in order to calculate the probability of proper function of technical objects under various conditions. (Tallert-FIRL)
W76-06313

GOVERNMENT-CONTRACTOR-ENGINEER LIAISON THAT CREATES AN ECONOMICAL PROJECT.
V. von Buchstab.
Engineering and Contract Record, Vol. 88, No. 13, p 40-42, Fall, 1975. 1 fig.

Descriptors: *Sewers, *Water treatment, *Treatment facilities, *Construction, *Economics, Engineering, Construction equipment, Governmental interrelations, Sewage treatment, Planning, Canada, Waste water treatment.
Identifiers: York Durham water and sewer project (Toronto).

The York-Durham water and sewer project in the Toronto region is under construction and will support 170,000 new homes and increased industrial development. The project is unusual because contractor-owner-engineer negotiations are being conducted and the contracting industry has been asked to contribute input to the final specs before official bidding. This liaison between government, contractors, and engineers should help develop economic and viable construction methods. The contracting industry is in close contact with equipment suppliers and tends to be knowledgeable about improvements in technology. In addition, when bids are put out during slow business periods, they tend to be more carefully written. Additionally, the advent of a standardization policy has helped in coordinating discussion and planning recommendations. (Kramer-FIRL)
W76-06319

THE FUTURE OF WATER RESOURCES,
Wessex Water Authority, Bristol (England).
K. Jackson.
Chartered Municipal Engineer, Vol. 102, No. 11, p 216-218, November, 1975.

Descriptors: *Water sources, *Water supply, Water management (Applied), Administration, Rivers, Aquifers, Groundwater, Surface waters, Desalination, Recharge.

Because of the prediction that by the end of the century demand for public water supplies may double, the newly established Water Resources Board of England and Wales has had to consider long-term schemes for supplying water. At present, river abstraction and regulation of river flow provides most water supplies. In heavily populated areas such as London, water from a river outside the area, such as the River Severn, may have to be piped to the Thames to regulate the flow and increase the London water supply. One such scheme is already under way: a link between the rivers Tyne, Wear, and Tees will supply the Northumbrian Water Authority area with water until the end of the century. Another form of river regulation being developed involves pumping water from underground strata to augment the river flow. This plan is currently being developed to augment the River Thames. Artificial recharge is a solution that involves feeding surface water into underground strata to improve the yield of boreholes sunk into the aquifer. This system utilizes natural storage as opposed to costly manmade storage. The idea of developing estuary storage by the construction of barrages is thought to be prohibitively expensive. Desalination is also too expensive to warrant use in England. Low-quality water supplies could be piped to industries and good quality sources could be reserved for drinking water. Combinations of these solutions could

provide sources in excess of the sum of the separate yields if each source is operated in isolation. (Loustau-FIRL)
W76-06324

INSTRUMENTS FOR WATER AND SEWAGE TREATMENT PLANTS (JOGESUDO KEISO KIKI),
Tokyo Shibaura Electric Co., Ltd. (Japan).
For primary bibliographic entry see Field 7B.
W76-06347

MONOGRAPH FOR THE EFFECTIVENESS AND COST OF WATER TREATMENT PROCESSES FOR THE REMOVAL OF SPECIFIC CONTAMINANTS, VOLUME II, KWIK INDEX,
Volkert (David) and Associates, Bethesda, Md.
I. C. Watson, S. J. Spano, H. N. Davis, and F. M. Heider.

Available from the National Technical Information Service, Springfield, Va 22161 as PB-242 443, \$5.00 in paper copy, \$2.25 in microfiche. Environmental Protection Agency, Report EPA-430/9-75-008, August, 1974. 83 p. 68-01-1833.

Descriptors: *Potable water, *Treatment, *Water treatment, *Waste water treatment, *Indexing, Bibliographies, Publications, Information exchange, Costs.
Identifiers: KWIK Index.

Information is presented on treatment processes for potable water supplies and their costs. Volume II consists of a KWIK Index which provides additional references for more detailed information on treatments and costs. The purpose of the report is to be a general planning document to give the user general concepts on what treatment methods are available to remove specific contaminants or reduce them below the limits required or recommended by the 1974 Federal Drinking Water Standards and Guidelines. Physical, biological, chemical and radiological contaminants are covered. Cost estimate curves and procedures are outlined in Volume I. The KWIK Index in Volume II is divided into reference, subject and author sections. The reference section is organized numerically. The subject section lists subjects, titles and reference numbers which allow cross-referencing to the reference section. The author section lists principal authors and also refers to the reference section. (Pinto-FIRL)
W76-06350

THE CONTROL AND OPERATION OF NUCLEAR DESALINATION SYSTEMS,
New South Wales Univ., Kensington (Australia).
School of Nuclear Engineering.
For primary bibliographic entry see Field 3A.
W76-06426

AUTOMATIC WATER DISTILLER,
C. C. Dennison.
U.S. Patent No. 3,935,077, 5 p, 4 fig, 4 ref; Official Gazette of the United States Patent Office, Vol 942, No 4, p 1867, January 27, 1976.

Descriptors: *Patents, *Water purification, *Water treatment, *Water quality control, *Water pollution treatment, *Water pollution control, *Distillation, Condensation, Evaporation, Domestic water, Condensers, Evaporators.

The automatic water distillation apparatus described is primarily designed for domestic use although it can be employed for commercial use. The system uses both air and water to cause condensation of the steam produced by an electrical evaporator. By utilizing water to cool the steam prior to supplying it to the evaporator, the amount of energy required by the evaporator to convert water to steam is reduced. The water distillation apparatus includes a base having a removable

shell. An insulated evaporator is enclosed within the shell and the base. A condensing chamber within the shell above the insulated evaporator has steam transported from the insulated evaporator. A water cooling and preheating chamber is above the condensing chamber with the water cooling and preheating chamber having a common wall with the condensing chamber to provide heat exchange. Water is supplied to the water cooling and preheating chamber to aid in cooling the steam in the condensing chamber. The condensing chamber has its outer wall spaced from the shell to form a passage and the flow of air through the passage aids in cooling the steam in the condensing chamber. Distilled water produced by condensation of the steam in the condensing chamber is collected by suitable means. (Sinha - OEIS)
W76-06469

CLARIFICATION PROCESS,
Georgia-Pacific Corp., Portland, Ore. (Assignee).
W. S. Briggs.
U.S. Patent No. 3,935,101, 11 p, 1 tab, 3 ref; Official Gazette of the United States Patent Office, Vol 942, No 4, p 1873, January 27, 1976.

Descriptors: *Patents, *Water treatment, Water quality control, Water pollution control, *Water pollution treatment, *Flocculation, Coagulation, Lignins, Settling basins, Suspended solids, Colloids, Chemical reactions, Separation techniques, Pulp wastes.
Identifiers: Lignosulfonates, Di-epoxides.

A clarification process for flocculation of solids suspended in an aqueous medium uses improved flocculating agents prepared from lignin and lignosulfonates. A water-soluble lignin-di-epoxide reaction product is obtained by reacting a lignin with a long chain, terminal di-epoxide having a molecular weight in the range of from 120 to 1800 to the extent that the phenolic hydroxyl content of the lignin has been reduced from about 40% to 95%. By reacting the lignin with a limited amount of epoxide under controlled conditions, cross-linking or bridging of the lignin by long chains is obtained resulting in formation of molecules having large entities held together at a distance from each other by non-rigid, flexible bonding. These products when dissolved in aqueous medium form loosely bound, flexible molecules having increased area for adsorption or entrapment of fine solid or colloidal particles in the solution or suspension to result in the flocculation of these particles. It is essential that the reaction be carried out under controlled alkaline conditions to prevent the lignin from reacting with the di-epoxide to the extent that the reaction product becomes water-insoluble. (Sinha-OEIS)
W76-06471

INTERIM PRIMARY DRINKING WATER STANDARDS.
Environmental Protection Agency, Washington, D.C.
For primary bibliographic entry see Field 5G.
W76-06522

10,000,000 GALLON PER DAY SECONDARY REFRIGERANT FREEZE DESALTING PLANT.
Dravo Corp., Pittsburgh, Pa. Blaw-Knox Chemical Plants Div.
For primary bibliographic entry see Field 3A.
W76-06549

5G. Water Quality Control

A MARGINAL COST BASIS FOR METROPOLITAN WATER SUPPLY ALLOCATION AND OPERATION,
Northwestern Univ., Evanston, Ill. Dept. of Civil Engineering.
For primary bibliographic entry see Field 6A.
W76-06164

THE ROLE OF GROUNDWATER IN RURAL SUPPLIES IN GHANA,
Ghana Water and Sewerage Corp., Bolgatanga.
For primary bibliographic entry see Field 4B.
W76-06169

PHILADELPHIA'S SOLID WASTES STRATEGY STRESSES PRIVATE SECTOR PARTICIPATION,
Philadelphia Dept. of Streets, Pa.
For primary bibliographic entry see Field 5E.
W76-06199

IMPLEMENTATION OF INTERSTATE WATER QUALITY PLAN,
Delaware River Basin Commission, Trenton, N.J.
C. H. J. Hull.
Journal of the American Society of Civil Engineers, Hydraulics Division, Vol. 101, No. Hy3, p. 495-509, 1974. 2 fig., 1 tab., 17 ref.

Descriptors: *Water quality standards, *Water quality control, *Interstate, *Delaware River Basin Commission, Comprehensive planning, Regulation, Administration, Self-purification, Low-flow augmentation, Encroachment, Saline water, Sewage districts, Estuaries.
Identifiers: Regional sewage facilities, Regional waste treatment.

An example of interstate regional water quality control is given by citing the scope and functions of the Comprehensive Plan of the Delaware River Basin Compact adopted by the Delaware River Basin Commission. The Plan includes policies, standards, criteria, and general goals, as well as physical projects and facilities deemed necessary by the Commission for water resources conservation, development, and management in the 13,000 sq mile four-state region. It is in effect a code of administrative laws and has the force of law. The use of the Basin's waters for controlled and regulated assimilation of treated wastes is recognized as a beneficial water use protected by the Comprehensive Plan. It includes provision of storage capacity for pollution abatement, for waste assimilation, and for control of seawater intrusion. The Commission has sponsored or participated in regional sewage treatment efforts and has established regional standards for DO levels. Compliance with the Basin's water quality plan is being effected by (1) consultative planning between the Commission and sponsors of water-related projects; and (2) formal detailed review of water-related projects before construction approval is granted. (Auen-Wisconsin)
W76-06201

FORMULATION AND USE OF PRACTICAL MODELS FOR RIVER QUALITY ASSESSMENT,
Geological Survey, Portland, Oreg. Water Resources Div.
W. G. Hines, D. A. Rickert, S. W. McKenzie, and J. P. Bennett.

Descriptors: *Performance, *Model study, *River, **Water quality, Planning, Management, Mathematical models, Data collection, *Oregon.
Identifiers: *Willamette River(Ore).

Considerations vital to formulation and use of practical river quality models applicable to planning and decision making are described. Deficiencies in modeling rationale are discussed and suggestions made for improvement in order to provide a basis for examining potential shortcomings in proposed models. Mathematical model can be used for river basin planning and management if premises and limitations are recognized, the model properly formulated, calibrated, and verified. Environmental factors and processes affecting river quality must be scientifically appraised. Successful appraisal depends on the complexity of physical conditions in each river basin and available

knowledge. Analysis of river hydrology (runoff, water temperature pattern, channel morphology) is essentially applied river quality model formulation. River hydrology is the most important single factor governing time and space variability in river quality behavior; it helps identify critical time period and reaches of the river for which a model may be effectively applied. Calibration and verification of models should be based on separate, statistically reliable data for variables and processes being modeled. To be valuable, model production runs must be understandable to users. The Willamette River, Oregon, data collection program is used to show the kinds of data required for river quality models. (Buchanan-Davidson-Wisconsin)
W76-06209

A COMPARATIVE STUDY OF CHEMICAL LOADINGS OF ACID AND NON-ACID TRIBUTARIES OF CHEAT LAKE, WEST VIRGINIA,
West Virginia Univ., Morgantown. Dept. of Biology.
For primary bibliographic entry see Field 5B.
W76-06213

WATER HYACINTHS FOR REMOVAL OF PHENOLS FROM POLLUTED WATERS,
National Space Technology Labs. Bay St. Louis, Miss.
B. C. Wolverton.

Available from the National Technical Information Service, Springfield, Va 22161, as N75-16128, \$3.50 in paper copy, \$2.25 in microfiche. NASA Report No. TM-X-72722, February 1975. 18 p. 3 fig., 3 tab., 30 ref.

Descriptors: *Absorption, *Water hyacinth, *Phenols, *Water pollution control, *Mississippi, Aquatic plants, Metabolism, Chemical wastes, Water pollution treatment.
Identifiers: Bay St. Louis(Miss).

Although water hyacinth (*Eichhornia crassipes*) is a serious aquatic weed problem in warm climates, it is a promising candidate for solving food supply, energy requirements, and water pollution problems. It is being investigated at the NASA National Space Technology Laboratories, Bay St. Louis, Mississippi, as a pollution abatement tool for removal of photographic and chemical laboratory wastes. The results of the study on the ability of water hyacinth to remove phenols from waters are described. Individual four-week and older plants were exposed to phenol in distilled water containing liquid plant food, East Pearl River water, or water from a Louisiana bayou. Recovery experiments indicated that water hyacinths removed phenol and rapidly metabolized it to other components. Translocation studies using C14 are in progress. Water hyacinths removed 36 mg phenol from distilled, river, and bayou water/g dry plant weight in 72 hours. One hectare containing approximately 1,620,000 plants could conceivably remove 160 kg phenol in 72 hours. A water filtering lagoon system is being built to test the use of water hyacinth and other vascular plants for pollution abatement. Hyacinth mats will be started in lagoons at various times as uptake is greater by plants in a rapid growth phase at pH 6.9-7.0. (Buchanan-Davidson-Wisconsin)
W76-06217

INVESTIGATIONS OF AQUATIC WEED CONTROL METHODS AND THEIR ENVIRONMENTAL EFFECTS ON NONTARGET AQUATIC SPECIES,
Bureau of Reclamation, Denver, Colo. Engineering and Research Center.
For primary bibliographic entry see Field 4A.
W76-06218

BIODETERIORATION OF NAVY INSECTICIDES IN THE OCEAN,
Civil Engineering Lab. (Navy), Port Hueneme, Calif.
For primary bibliographic entry see Field 5B.
W76-06219

THE ROLE OF POLLUTE TAXES IN EXTERNALITY PROBLEMS,
Boston Coll., Chestnut Hill, Mass.
M. Kraus, and H. Mohring.
Economica, Vol. 42, No. 166, p. 171-176, 1975. 1 fig., 4 ref.

Descriptors: *Pollution taxes(Charges), Third party effects, Resource allocation, Equity, Indirect costs, Indirect benefits.

A serious problem exists in incorporating technological externalities in pollution taxes where de facto externalities involve multiple local optima and both complex and changing interrelations, due to the impossibly costly information requirements necessary to design a pricing system for externalities that would enable moving in one step from an existing, nonoptimum allocation of resources to a globally optimum allocation. The rationalizations for taxing polluters (those damaged by technological externalities) as well as polluters by recursive taxing schemes are considered attractive only because of their small information requirements. The arguments posed by Coase (1960, p. 42), Baumol (1972), and Mohrin and Boyd (1971) for site relocation of polluters or taxes on polluters to account for the marginal pollution costs incurred by the polluter due to the polluters' locational decisions into the polluter's environs, are assessed. The conclusions are that in a world of multiple local optima, neither sequentially adjusted polluter taxes alone nor such taxes coupled with sequentially adjusted site taxes on polluters would be relied on to achieve a global optimum. And, there appears to be no inexpensive mechanism for obtaining global optimality in externality problems involving multiple local optima. (Auen-Wisconsin)
W76-06226

THE POLITICAL ECONOMY OF EFFLUENT CHARGES,
Pennsylvania State Univ., University Park. Center for the Study of Environmental Policy.
T. A. Ferrar, and P. Sassone.
Working Paper No. 5, May 1974. 16 p. 2 fig., 14 ref.

Descriptors: *Pollution taxes(Charges), *Political aspects, *Equity, Industries, Effluents, Theoretical analysis.

It is posited that any environmental policy must pass certain political acceptability tests before it may be implemented and that political constraints effectively prohibit the construction of an optimal effluent charge. Two conditions are introduced that an effluent charge scheme would likely be required to satisfy and it is demonstrated that, in general, no optimal effluent charge that satisfies these conditions is available. (1) The traditionally accepted principle is that 'equals must be treated equally', i.e., any two firms producing the same effluent should face the same effluent rate structure. Under this principle it is mathematically demonstrated that the equity requirement is a severe restriction on the efficiency of effluent charges. (2) Alternatively, if it is required that each firm be held strictly self-accountable on its effluent behavior, under the self-accountability condition effluent charges also cannot yield socially optimal resource allocation if the cost function does not exhibit these conditions. It is pointed out that if this strict accountability condition is essential for operational policy, then only under the restrictive technological condition could an optimal effluent charge policy be established. It is not proposed that no effluent charge policy should be implemented but rather the question posed is whether a specific policy is an improvement over available policy alternatives. (Auen-Wisconsin).

Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

Group 5G—Water Quality Control

W76-06228

WATER CONTENT AND BULK DENSITY CHANGES IN A SOIL PEDON MEASURED WITH DUAL ENERGY GAMMA-RAY TRANSMISSION

Agricultural Research Service, Phoenix, Ariz. Water Conservation Lab.
R. J. Keginato.
Can J Soil Sci. 54(3): 325-328. Illus. 1974.

Descriptors: *Soil density, *Soil water, *Measurement, *Water measurement, *Instrumentation, Soil profiles, *Soil density probes.
Identifiers: *Gamma-ray transmission technique, *Pedon.

Water contents and bulk densities were measured in a soil pedon with a gamma-ray transmission technique utilizing 137Cs and 241Am. By alternating the sources for each scan down the soil profile, both bulk density and water content were determined in 1-cm increments in the top 10 cm of the pedon. Bulk density decreased to a depth of 6 cm about 30 min after 4 cm of water was ponded on the soil surface. As soon as the water drained from the surface, bulk density values increased and approached pre-irrigation levels. Water content increased rapidly corresponding to the decrease in bulk density. Assuming that the bulk density remains constant during ponding, calculated water contents may be in error by as much as 0.25 gcm⁻³.
-Copyright 1975, Biological Abstracts, Inc.
W76-06238

THE ROLE AND FUNCTION OF VERDURE IN PROTECTING THE HUMAN ENVIRONMENT.

Polskie Towarzystwo Przyrodników im. Kopernika, Warsaw.
For primary bibliographic entry see Field 4C.
W76-06240

DEVELOPMENT OF AN ECONOMIC/ENVIRONMENTAL PLAN FOR DENTS RUN WATERSHED, WEST VIRGINIA.

Halliburton Services, Duncan, Okla.
Available from the National Technical Information Service, Springfield, Va., 22161, as PB-242 671 \$4.50 in paper copy, \$2.25 in microfiche. Final report. Prepared for the Appalachian Regional Commission, Washington, D.C. March 1973. 75 p, 11 fig, 2 tab, 4 ref. EPA 14010-HQC-2.

Descriptors: *Pollution abatement, *Watershed management, *Solid wastes, Environmental sanitation, *Environmental control, *Coal mine wastes, *Sewage disposal, *Costs, Air pollution, Water pollution control, *West Virginia.
Identifiers: Dents Run(WV), *Dents Run watershed(WV), Cost estimates, Junked cars.

This watershed of 14.6 sq mi contains two cities, Granville (population 1050) and Westover (population 5089). The very polluted flow of Dents Run consists of water from coal mining operations or abandoned mines, except during the rainy season. A survey to discover pollution sources revealed four main sources: sewage discharge into the Monongahela River and Dents Run, trash and garbage, junk cars, and coal mine fires. Plans for and costs of correcting environmental problems are discussed. Short range plans last up to six months and are mainly educational while long range plans require more initiation time, new laws or additional funding. Sewage disposal is the major problem. Aside from educational efforts, this will require the building of septic tanks at owner's expense at rural home locations, and a sewage treatment plant for urban locations. Four plans are given, each at a different capital and operating cost. Solid waste collection could be handled by towns individually or through a public service district. The recommended plan encompasses the entire county. This serves the most people at the

lowest cost per person. Costs for removing junked car bodies are expected to exceed the value of the cars, so that government or private help is needed to locate cars, determine ownership, acquire the rights and haul to a shredder. The last problem surveyed was that of extinguishing burning coal outcrops. Coal mine operators may extinguish the fires as a 'good neighbor policy'. Otherwise it must be done at public expense. Cost estimates for work, sources of funds, and authorities involved are presented. (Smith - North Carolina)
W76-06270

AN APPROACH TO A WATER QUALITY INDEX FOR CANADA,

Department of the Environment, Ottawa (Ontario). Science Policy Branch.
H. Inhaber.

Water Research, Vol. 9, p. 821-833, September 1975. 14 fig, 5 tab, 7 ref.

Descriptors: *Water quality, Pollutants, *Standards, *River basins, *Industrial wastes, *Municipal wastes, Water pollution, Water supply, Recreation, Water quality standards, Mercury, Data, Metals, *Canada.
Identifiers: *Water Quality Index (WQI), Industrial and Municipal Effluent Index, Ambient Water Quality Index.

A Water Quality Index (WQI) (part of an Environmental Quality Index) is conceptually similar to economic indices such as Gross National Product though more difficult to obtain because of problems of nonuniform and qualitative data. To construct an index data must be available on a national scale. Here each of several subareas was treated to cover a range of pollutants. They were designed to reflect the magnitude of polluted effluent, the effect of pollution abatement, and some secondary effects such as contamination of water supplies and fisheries. Subindices obtained are combined mathematically through the root-mean square method which accentuates values farther from the mean. Group 1 is the Industrial and Municipal Effluent Index which covers municipalities and 4 major Canadian industries (petroleum refining, pulp and paper, fish processing, and chlor-alkali). To include different wastes in a combined index the constituents were rated relative to one another on the basis of the estimated importance of their effect on 3 water uses, suitability for drinking, fish and aquatic life, and recreation. A most stringent criterion was used to state the minimum concentration of a waste at which any of the water uses would be impaired. Group 2 is the Ambient Water Quality index which deals with trace metal contamination of water supplies, river quality in terms of turbidity, and mercury contamination of fish landed commercially. The indices are combined mathematically. Because of lack of data, it has not yet been possible to compile an overall quality index for specific rivers or basins. (Smith - North Carolina)
W76-06272

PLANNING A MUST FOR GROUNDWATER DEVELOPMENT,

Clinton Bogert Associates, Fort Lee, N.J.
For primary bibliographic entry see Field 4B.
W76-06273

USING WASTEWATER SOLIDS TO RECLAIM STRIP-MINED LAND.

Metropolitan Sanitary District of Greater Chicago, Ill.
H. McMillan, and R. Carlson.
Transactions of the Society of Mining Engineers, Vol. 258, No. 4, p. 273-278, December, 1975. 4 fig, 5 tab, 5 ref.

Descriptors: *Land reclamation, *Waste water treatment, *Strip mines, Waste disposal, Sludge disposal, Acid mine water, Liquid wastes, Crops.
Identifiers: Land application, Chicago(Ill).

To cope with 700 dry tons of waste water solids produced each day, the Sanitary District of Chicago chose land application, and conducted tests before initiating a strip-mined land reclamation program. One demonstration project undertaken by the Sanitary District showed that annual yields of corn were consistently higher with sludge application than without it. Another demonstration involved reclamation of acid strip-mined land. Applications of liquid sludge supported cover crops while the control with no sludge did not. Samples of drainage water from the mine showed that the vegetation growth retarded the rate of acid production. The pH of the surface soil after liquid application was high enough to keep the metals from going into solution. A sophisticated research project was conducted at the University of Illinois. Drainage water from plots of various soils treated with liquid waste was analyzed. After passage through a natural sand filter, drainage water consistently contained less than the standard limit for nitrate. Addition field experiments with corn and soybeans showed that the liquid fertilizer was an effective source of nitrogen and phosphorus for crops. Encouraged by the results of the University tests and its own demonstration program, the Sanitary District purchased 10,000 acres of land that had been strip-mined for coal. The Sanitary District plans to apply 75 dry tons of sludge per acre the first year, 60 tons the second year, 45 tons the third year, and 30 tons the fourth year, at which point the program will be reevaluated. (Loustau-FIRL)
W76-06287

THE WATERSHED APPROACH TO UNDERSTANDING OUR ENVIRONMENT,

Agricultural Research Service, Fort Collins, Colo. D. A. Woolhiser.
Journal of Environmental Quality, Vol. 4, No. 1, p. 17-21, January/March, 1975. 2 fig, 25 ref.

Descriptors: *Model studies, Watersheds(Basins), Water management(Applied), Mathematical models, Runoff, Decision making, *Agricultural watersheds.

Current approaches used in modeling the agricultural watershed include the formal, mathematical model and the material, representational model. Formal models allow predictive statements to be made; material models provide interpretation of three-dimensional flow in a porous medium with surface runoff, but are simpler to work with than the real system. Formal models consisting of sets of partial differential equations can be simplified by reducing their dimensionality to one space, by treating groundwater flow as a steady-state problem, and by using 'lumped' or compartment models to eliminate spatial variability. Non-homogeneities or spatial variability can be included in a material model. The model would first include spatial variability and then would be modified so that such variability would be averaged in some sense. Models are used in the decision-making process; therefore, they must include only the most important of subprocesses involved or they will become unduly cumbersome. When a model is developed for one purpose, it cannot be used for another application. (Loustau-FIRL)
W76-06311

WATER-SAVING DEVICES: THE STATE OF THE ART,

Pennsylvania State Univ., University Park. School of Forest Resources.
For primary bibliographic entry see Field 3D.
W76-06317

A FRAMEWORK FOR EVALUATING INSTITUTIONAL AND SOCIO-ECONOMIC ISSUES OF LAND TREATMENT OF WASTE WATER,
Economic Research Service, Upper Darby, Pa. Natural Resource Economics Div.
L. A. Christensen.

Journal of Environmental Quality, Vol. 4, No. 2, p 145-153, April/June, 1975. 1 fig, 1 tab, 27 ref.

Descriptors: *Waste water disposal, *Nutrient removal, *Regional planning, Land management, Land development, Management.

Identifiers: Land application, Socioeconomic planning.

Land treatment involves the application of waste water to vegetation producing land for adsorption of nitrates and phosphates by soil and plants. To encourage a multidisciplinary approach to land treatment planning, some institutional and socioeconomic issues are highlighted here through a discussion of alternative means of acquiring and managing land treatment sites. If a public agency purchases the land by fee simple acquisition, management can be handled by subcontracting for custom farm operations, or the land can be leased to farmers. The land can also be resold for private use with some legitimate conditions. Easement purchase, or partial property rights purchase, is another alternative which has the advantage that management is left in the hands of the private owner. A new approach to land access is municipal and private cooperative ownership with division of management costs. Some examples are given of existing systems and their management. (Loustau-FIRL)

W76-06320

WATER QUALITY MANAGEMENT FOR METROPOLITAN KANSAS CITY, Black and Veatch, Kansas City, Mo. O. J. Schmidt.

Journal of the Environmental Engineering Division, Proceedings of ASCE, Vol. 101, No. EE6, p 935-946, December, 1975. 5 fig, 3 ref.

Descriptors: *Water quality control, *Sewerage, *Planning, *Kansas, Missouri, Municipal wastes, Municipal water, Waste water treatment, State jurisdiction.

Identifiers: *Kansas City(Mo).

Lack of centralized sewerage planning for metropolitan areas has resulted in problems of inadequate facilities, untrained operators, and expensive duplication costs. This study of the metropolitan Kansas City water treatment systems points to the new and much-needed trend toward unified water treatment planning and management for metropolitan areas. The specific problems encountered in the Kansas City metropolitan area were watersheds crossing state lines and differing policies of the two states for treatment. Seven options for managing the eight counties on both sides of the Kansas-Missouri line were developed by Black and Veatch, Consulting Engineers. These options include organizing a water management agency for the entire metropolitan area, organizing agencies along county lines, and organizing agencies along watershed districts. Because interstate cooperation might still be difficult to achieve, a combination county-watershed system of agencies was thought to be the most appropriate. Although legislation already exists allowing interstate management, more legislation may be needed to strengthen this power. Whatever design is chosen, it is recommended that the number of management agencies be reduced to as few as possible and that cooperation in planning and operating be encouraged. (Loustau-FIRL)

W76-06323

DEALING WITH THE DISCHARGE MONITORING REPORT,

San Antonio Wastewater Treatment Plant, Tex. J. D. Holm.

Water and Sewage Works, Vol. 122, No. 12, p 62-63, December, 1975. 4 fig.

Descriptors: *Monitoring, *Legislation, *Waste water treatment, *Treatment facilities, Biochemical oxygen demand, Suspended solids, Water quality control, Effluents, Texas.

Identifiers: Effluent discharges, San Antonio(Tex).

Some problems of the discharge monitoring report, EPA Form 3320-1 (10-72), were solved by the San Antonio Waste Water Treatment Plant. A work sheet, a smaller, more concise version of the EPA Form, was prepared on 8-1/2 by 11 inch paper. Examples of the large form and the work sheet are reproduced in the article. A form letter, also reproduced in the article, was then prepared for weekly reports. Details of reporting and recording are given. For plants which have not yet made the calculations for the biochemical oxygen demand and the total suspended solids loadings, the computation is as follows: the effluent quantity in mgd is multiplied by the parameter effluent concentration in mg/liters; that product is then multiplied by a conversion factor of 3.785 to obtain the loading in kg/day. The conversion factor results from multiplying 8.345 pounds per gallon by 0.4536 kilograms per pound. (Loustau-FIRL)

W76-06325

CONTROLLING POLLUTION FROM COMBINED SEWERS,

Hydrocomp, Inc., Palo Alto, Calif.

For primary bibliographic entry see Field 5D.

W76-06328

HOW THE GREAT LAKES WERE EVALUATED,

Great Lakes Basin Commission, Ann Arbor, Mich.

W. C. Sonzogni.

Environmental Science and Technology, Vol. 9, No. 10, p 929-928, October, 1975. 1 tab.

Descriptors: *Great Lakes region, Water management(Applied), Planning, Data collections, Government support, Legislation, Environmental effects, Evaluation.

The Great Lakes Basin Framework Study produced 6,000 pages of report and appendices to provide a broad-scale analysis of resource needs and problems in the U. S. portion of the Basin. This article gives a brief description of the report and its 23 appendices (divided into six general categories). The first part concerns alternative frameworks. The second set of appendices give basic resource information. Water resources use and management is the topic of the third category. Land resources use and management is the fourth category. The fifth discusses economic, social, and institutional studies, laws, and policies, and the sixth discusses environmental quality. The main report is a general summary of the appendices. In addition, an Environmental Impact statement and a special critique of the Framework Study were prepared. The statement summarizes the impacts and possible adverse effects of the Framework Study's plans. A group of governmental agencies and public interest groups critically examined the issues and questions which arose from the Framework Study. The report provides information for scientists, engineers, planners, and conservationists. (Loustau-FIRL)

W76-06329

MANAGEMENT OF AN EFFECTIVE MAINTENANCE PROGRAM,

California State Univ., Sacramento. Dept. of Civil Engineering.

K. D. Kerri, and J. Brady.

Water and Sewage Works, Vol. 122, No. 11, p 56, November, 1975.

Descriptors: *Waste water treatment, *Operation, *Maintenance, *Storm runoff, Treatment facilities, Inflow, Infiltration, Water management(Applied), Administration.

Improper operation and maintenance of waste water collection systems can create many

problems. Untreated waste water flowing down streets and water courses during stoppages and storms can cause health hazards. Lack of proper installation, preventive maintenance, surveillance, and repair programs can result in system failures. The collection system, lift stations, and treatment plants can produce odors. Shock loads that upset treatment processes can occur. Equipment and structures can become corroded. Use of a valuable portion of the capacity of the facilities can be taken up by inflow and infiltration. Problems from system failures can result in complaints from the public or from local officials. To effectively operate and maintain a waste water treatment plant, managers must establish a good set of procedures for planning and recording the activities of the maintenance program. Managers must also train their maintenance forces to apply these programs. (Loustau-FIRL)

W76-06333

PRACTICAL RESEARCH IN WATER POLLUTION CONTROL,

University Coll., Cardiff (Wales). Dept. of Microbiology.

For primary bibliographic entry see Field 5D.

W76-06340

HOW TO IMPROVE PLANT EFFICIENCY, Environmental Protection Agency, Washington, D.C. Office of Water Programs Operations.

W. G. Gilbert.

Water and Sewage Works, Vol. 122, No. 11, p 58, November, 1975.

Descriptors: *Waste water treatment, *Treatment facilities, *Municipal wastes, *Monitoring, Government finance, Water quality standards, Legislation, Performance, Water pollution control.

A compilation of reports from surveys conducted over three years revealed that about one-third of the nation's municipal treatment facilities constructed with Federal grant assistance are not operating at their designed efficiency levels. To improve the efficiency and reliability of treatment facility performance, local, state and Federal programs must establish tighter control and monitoring. Operators must be well trained and certified. Violations of permit limitations must be pursued aggressively and corrected. Operational expertise must be applied to the planning and design levels. Plant performances must be monitored and evaluated. New and simplified laboratory procedures must be tested. Adequate operating budgets at the local level must be provided. Proper operation and maintenance of existing plants is essential for reaching and maintaining effluent quality standards. (Loustau-FIRL)

W76-06342

DETERGENT PHOSPHATE BAN YIELDS LITTLE PHOSPHORUS REDUCTION, PART II,

Purdue Univ., Lafayette, Ind. Dept. of Environmental Engineering.

J. E. Etzel, J. M. Bell, E. G. Lindermann, and C. J. Lancelot.

Water and Sewage Works, Vol. 122, No. 10, p 91-93, October, 1975. 8 fig, 6 tab.

Descriptors: *Legislation, *Detergents, *Phosphates, *Phosphorus, Waste disposal, Eutrophication, Bioassay, *Indiana, Rivers, Nutrient removal, Sewage disposal, Sewage treatment.

The legislative ban in Indiana on detergent phosphates has failed to reduce the remaining stream phosphorus to levels low enough to be of any biological significance in reducing the potential for algal growth. Results of a 1974 study show that despite the existence of the statewide ban for 1.5 years, mean total-P concentrations are 110 to over 2000 ppb throughout the studied rivers. This

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Group 5G—Water Quality Control

is considerably higher than the 10 to 50 ppb generally considered to be the range in which phosphorus can limit excessive algal growth. Laboratory bioassays all failed to show a positive growth response to phosphorus spiking. No correlation was found between total phosphorus levels and observed fertilities in the studied rivers. Data for specific sections of rivers studied are given in tables. It has been found, however, that nutrients can be reduced from sewage treatment plant discharge through flocculation. (See also W76-03235 and W76-06346) (Loustau-FIRL) W76-06345

DETERGENT PHOSPHATE BAN YIELDS LITTLE PHOSPHORUS REDUCTION, PART III, Purdue Univ., Lafayette, Ind. Dept. of Environmental Engineering. J. E. Etzel, J. M. Bell, E. G. Lindemann, and C. J. Lancelot. Water and Sewage Works, Vol. 122, No. 11, p 68-70, November, 1975. 1 fig, 2 tab, 11 ref.

Descriptors: *Water quality control, *Legislation, *Phosphates, *Detergents, *Indiana, Biological treatment, Sewage treatment, Water pollution effects, Chemical precipitation, Flocculation. Identifiers: Legislative bans.

The legislative ban on detergent phosphates in Indiana has failed to reduce the remaining stream phosphorus to levels low enough to be of any biological significance. The results of the 1974 study that reveal the failure are detailed in tables and a graph. Whether or not the actual phosphorus concentration has been decreased is debatable but not the real issue. What is significant is that the ban limitations are still too high to limit algal growth. In addition, the ban on detergent phosphates may have confused the public of the overall objective. The idea that chemical precipitation is solely a phosphorus removal step is a misunderstanding. Chemical precipitation greatly increases the removal of all nutrients, including residual BOD, from treated sewage. The elimination of detergent phosphates alone has not upgraded the quality of treated water. Other phosphorus reductions must also be made, and chemical flocculation steps are needed in all treatment systems if the State's water quality standards are to be met. (See also W76-03235 and W76-06345) (Loustau-FIRL) W76-06346

REGIONAL WASTE WATER DEVELOPMENT PLAN: ANALYSIS OF EXISTING FACILITIES. Alamo Area Council of Governments, San Antonio, Tex. For primary bibliographic entry see Field 5D. W76-06351

SEWER/WATER PREFERRED LONG RANGE PLANS. Northern Middlesex Area Commission, Lowell, Mass. January 1972. 62 p, 5 fig, 4 tab, 5 append.

Descriptors: *Sewers, *Sewage districts, *Comprehensive planning, *Water distribution (Applied), *Water management (Applied), Sewage treatment, Water districts, Costs, Water demand, Utilities, *Massachusetts, Treatment facilities. Identifiers: Northern Middlesex Area(MA), Billerica(MA), Chelmsford(MA), Dracut(MA), Dunstable(MA), Lowell(MA), Pepperell(MA), Tewksbury(MA), Tyngsborough(MA), Westford(MA), Merrimack River(MA).

The proposed sewer and water plan for Northern Middlesex Area is intended to serve as a basis for coordinating local efforts, as a framework for review of proposed projects, and as a major tool in the implementation of the future land use plan. As general utility policies, the following recommenda-

tions are made: (1) Major responsibility for administration of utilities should remain at the local level. A regional mechanism could reduce local costs by facilitating such activities as central purchasing, sharing of special equipment, and sharing of trained personnel. (2) Utility planning at the local level should be assisted by a continuous process of comprehensive planning. (3) Locations of future industries should be influenced by planning and zoning to minimize utility costs. (4) An advisory committee of experts, local citizens and officials should assist in planning and coordinating agreements between and among utility districts. Three subregional sewerage systems are recommended: Lowell-Tewksbury-Dracut, Billerica, and Chelmsford-Westford-Tyngsborough-Pepperell. On site disposal is appropriate for Dunstable. Joint commissions are to administer these regional systems and determine a fair accounting method for sharing cost savings. Water systems must be concerned with sharing sources of supply, future development of larger combinations of existing water supply systems, and inter-system connections and coordination. Beyond 1975 the zoned capacity of the Lowell water treatment plant will have to be expanded to meet demand. This need could be met by a regional water treatment plant or by a Northern Middlesex Area Water District built around facilities on the Merrimack River. (See also W76-06353) (Henley-North Carolina) W76-06352

SEWER AND WATER FACILITIES IN THE NORTHERN MIDDLESEX AREA, SHORT RANGE PRIORITY PROGRAM 1972-1977. Northern Middlesex Area Commission, Lowell, Mass. June 1972. 36 p, 3 tab, 1 map, 3 append.

Descriptors: *Sewers, *Water supply, *Water demand, *Water distribution (Applied), *Effluents, Pollution, Sewage treatment, Water quality, Water management, Planning, *Treatment facilities, *Massachusetts. Identifiers: Northern Middlesex Area(MA), Merrimack River(MA).

This program has been developed to meet HUD's and EPA's requirements for establishing priorities for development of sewer and water facilities in order to maintain eligibility for capital grants. Its first concern is to provide a coordinated regional framework for the development of necessary waste treatment facilities directed at eliminating the dumping of untreated sewage into waterways. The Massachusetts Division of Water Pollution Control has issued schedules for the correction of raw sewage discharge to the communities of Lowell, Dracut, Chelmsford, Pepperell and Billerica. These areas then receive priority in the development of sewerage systems. The second priority level is concerned with eliminating possible health hazard areas and/or servicing areas of dense residential or commercial development. Knowledge of the complex factors which influence the water environment is far from complete. Deficiencies, gaps, and conflicts in the program are recognized. Federal, state and local governments and regional planning bodies are expected to participate in implementing the sewerage program. The second major concern is with the development of a short range (5 years) priority water systems program. Ground water supplies are becoming increasingly insufficient and unsafe. More communities are turning to the Merrimack River for their water supply. Possible economies of scale are promoting community cooperation in capital investment programs for expanding treatment facilities. In order to meet the first priority of meeting the demand for water in areas suffering from continual or seasonal water shortage, capacity of the Lowell treatment plant should be increased by at least 100%. (See also W76-06352) (Henley - North Carolina) W76-06353

MINE SPOIL RECLAMATION RESEARCH AT THE BELLE Ayr MINE, NORTHEAST WYOMING. Forest Service (USDA), Fort Collins, Colo. Rocky Mountain Forest and Range Experiment Station. H. K. Orr. In: Proceedings Fort Union Coal Field Symposium, April 1975, Billings, Montana, Montana Academy of Science, Billings, Vol. 3 p 304-307. 1 tab, 2 ref.

Descriptors: *Coal mine wastes, *Vegetation establishment, Mine hydrology, Overburden, Spoil banks, *Wyoming, Watershed management. Identifiers: *Mine spoil reclamation, Surface coal mining, Vegetation reestablishment.

Surface mining of coal drastically alters plant-soil-water relationships. Gross effects are of concern to managers as well as means of minimizing undesirable impacts. Ground water impact are of special concern in the semiarid environment of the western Great Plains. Revegetation is a primary step in reclamation for control of surface runoff, erosion, sedimentation, and for aesthetics. Initial trials with shrubs and trees have been only moderately successful. Lack of moisture is a primary limiting factor. Reclamation requirements justify the design of additional cultural treatments to insure success of revegetation. (Forest Service) W76-06361

TREND SURFACE ANALYSIS OF POWDER RIVER BASIN, WYOMING - MONTANA. Forest Service (USDA), Fort Collins, Colo. Rocky Mountain Forest and Range Experiment Station. For primary bibliographic entry see Field 4A. W76-06363

COAL MINE SPOIL AS A GROWING MEDIUM: AMAX BELLE Ayr SOUTH MINE, GILLETTE, WYOMING. Forest Service (USDA), Fort Collins, Colo. Rocky Mountain Forest and Range Experiment Station. T. Yamamoto. In: Third Symp. on Surf. Min. and Reclam., Vol 1: p 49-61, 4 tab, 33 ref. NCA/BCR Coal Conf. and Expo. II (Louisville, KY, Oct. 1975) Nat'l Coal Assoc. Washington, D. C.

Descriptors: *Land reclamation, Overburden, *Wyoming, *Strip mines, Soil chemical properties, Soil physical properties, *Fertility, *Vegetation establishment, *Soil moisture. Identifiers: Spoil salinity, AMAX coal mine, Campbell County(Wyo), Fort Union Formation, Wasatch Formation, Coal spoil reclamation.

The geologic materials overlying coal beds—called spoils after the coal has been removed—have unique physical and chemical properties. They are not 'soil' in a pedologic sense, nor are they geologically the same as the rock formations from which they were derived. Their unique properties sometimes pose problems in revegetation attempts. As a first step in understanding spoils, samples from the AMAX Coal Company in Campbell County, Wyoming were analyzed by standard agricultural soils analysis procedures. The spoils were overburden from the Roland and Smith coal beds of the Fort Union Formation. Coal from this formation represents the greatest strippable deposit in Wyoming. Although slightly more saline than the surrounding natural soils, the spoil salinity is not enough to severely limit plant growth or survival. The general nutrient status of the spoils is low for ideal plant growth, but the generally loamy texture is favorable. Furthermore, the homogeneity of physical properties and dressed spoil depth provide a moisture reservoir capacity consistent with capacities of natural soils. Thus, favorable response is anticipated from the AMAX spoils material as a growing medium. (Forest Service) W76-06364

BEHAVIOUR OF OIL UNDER CANADIAN CLIMATIC CONDITIONS PART 1. OIL ON WATER UNDER ICE-FORMING CONDITIONS.
Department of the Environment, Ottawa (Ontario). Inland Waters Directorate; and Department of the Environment, Ottawa (Ontario). Water Quality Branch.
B. F. Scott, and R. M. Chatterjee.
Scientific Series No 50, 1975, 21 p, 15 fig, 16 ref, 8 tab, append.

Descriptors: *Ice, *Oil, Water pollution sources, Water pollution, *Oil pollution, Investigations, Water pollution effects, Environmental effects, Analytical techniques, Research and development, Chromatography, Gas chromatography, *Pollutant identification, Monitoring.

Oil was poured onto a water surface under ice-forming conditions. Weather conditions were monitored continuously, as were the physical properties of the oil and the effect of the oil on its physical environment. Properties of the oil were investigated by gas chromatography and the following forms of spectroscopy: neutron activation (gamma-ray), infrared, ultraviolet, visible and fluorescence. The weathering of the oil and its influence on its environment were correlated with the weather parameters. An estimated 50% of the oil had evaporated before the oil was covered with snow, as determined by gas chromatographic analysis and supported by neutron activation analysis. A biological assessment was conducted during the following summer where the effect of the oil on one pond was compared with the control pond. In the oiled pond, the variety of biological species was substantially less than in the control pond. (Environment Canada)
W76-06366

CANADA WATER ACT - ANNUAL REPORT, 1973-74.
Department of the Environment, Ottawa (Ontario).
For primary bibliographic entry see Field 6E.
W76-06369

REVIEW OF HEATED DISCHARGE MANAGEMENT AND CONTROL ALTERNATIVES, ONCE-THROUGH SYSTEMS IN LARGE WATER BODIES.
Maclaren (James F.) Ltd., Willowdale (Ontario).
For primary bibliographic entry see Field 5B.
W76-06372

MINE AND MILL WASTEWATER TREATMENT.
Environmental Protection Service, Ottawa (Ontario). Water Pollution Control Directorate.
For primary bibliographic entry see Field 5D.
W76-06373

CONTROL OF ABSTRACTION BY LAW.
For primary bibliographic entry see Field 6E.
W76-06423

WATER QUALITY CONTROL SYSTEM OF ZAGYVA RIVER BASIN.
Research Inst. for Water Resources Development, Budapest (Hungary).
I. Ijás.
Working Paper No. 38, UNDP/UN Interregional Seminar on River Basin and Interbasin Development, Budapest, Hungary, September 1975. 18 p, 16 eq, 10 ref. (United Nations, Department of Economic and Social Affairs).

Descriptors: *River systems, *Water quality control, *Linear programming, *Dynamic programming, *Simulation analysis, Optimization, Operating costs, Treatment facilities, Planning, Constraints, Biochemical oxygen demand, Mathematical models, Computer programs, Systems analysis.

Identifiers: *Zagyva River basin (Hungary).

A long-term research program of the Institute of Water Management and Hydraulic Engineering at the Technical University in Budapest has been concerned with water quality control in river basins. A goal has been the introduction of water quality system tests into teaching, research work, and engineering practice. On the basis of published experience, mathematical models and computer programs have been developed for water quality system tests, including hydrology and water quality predictions, mathematical simulation of self-purification, water quality variation, and optimum development of water quality control systems. The developed models and programs have been tried in water quality system tests of the Zagyva River, which has its source and most of its catchment area in Hungary. Advantageous was the proposed construction of an automatic water management control system in the Zagyva basin, automatically recording a great many data to facilitate water quality system tests, and thus the development of a water quality control system. (Bell-Cornell)
W76-06430

SYSTEMATIC APPROACHES TO ENVIRONMENTAL IMPACT ASSESSMENT: AN EVALUATION.
Ohio State Univ., Columbus. Dept. of Civil Engineering.
For primary bibliographic entry see Field 6G.
W76-06431

TRANSIENT WATER QUALITY MODELING IN STREAMS.
Cornell Univ., Ithaca, N.Y. School of Civil and Environmental Engineering.
For primary bibliographic entry see Field 5B.
W76-06433

WATER QUALITY PLANNING STRATEGY.
Camp, Dresser and McKee, Inc., Boston, Mass.
G. R. Grantham, and T. E. Bailey.
Journal of the Water Resources Planning and Management Division, Proceedings of the American Society of Civil Engineers, Vol. 102, No. WR1, Proceedings paper No. 12060, p 11-22, April 1976. 8 fig, 11 ref.

Descriptors: *Water management (Applied), *California, *Control, *Coordination, *Planning, *Water quality, Water resources, Legislation, State governments.

The California State Water Resources Control Board created the Office of Technical Coordination (OTC) to coordinate and oversee the administrative and technical effort required for the formulation of a planning program to preserve and enhance the quality of the State's water resources. The project included the development of water quality planning for each of the 16 hydrologic basins. Begun in 1970, the program complies with Federal requirements initially established in 1970 and new requirements imposed in 1972 by PL 92-500 and with the State's Porter-Cologne Act. Both laws require the preparation of water quality control plans for the State's 16 basins. With the enactment of these laws, significant changes were required in current water resources management method and practices. The fundamental changes with the greatest impact were in the areas of multi-agency coordination, use of multidisciplinary planning procedures, and implementation of a comprehensive step-wise planning strategy. (Bell-Cornell)
W76-06439

NUTRIENT TRANSFORMATIONS IN MASS CULTURES OF MARINE ALGAE.
Woods Hole Oceanographic Institution, Mass. Dept. of Biology.
For primary bibliographic entry see Field 5C.
W76-06441

HYDROLOGIC EVALUATION OF SALINITY CONTROL AND RECLAMATION PROJECTS IN THE INDUS PLAIN, PAKISTAN--A SUMMARY.
Geological Survey, Reston, Va.
M. J. Mundorff, P. H. Carrigan, Jr., T. D. Steele, and A. D. Randall.
Available from Superintendent of Documents, Government Printing Office, Washington, D.C. 20402, \$2.95 in paper copy. Water-Supply Paper 1608-Q, 1976. 59 p, 4 fig, 2 plates, 9 tab, 43 ref.

Descriptors: *Water quality control, *Salinity, *Surface waters, *Groundwater, *Foreign projects, *Asia, Evaluation, Water supply, Water utilization, Irrigation, Reclaimed water, Water analysis, Water quality, Aquifer characteristics, Canals, Brackish water.
Identifiers: *Pakistan, *Indus Plain, *Tubewells.

Summarized are findings of a team of four specialists from the U.S. Geological Survey assigned to Pakistan under the auspices of the U.S. Agency for International Development during May to August 1972 for a hydrologic evaluation of Salinity Control and Reclamation Projects in the Indus Plain. Studies were related to climatology, surface-water hydrology, and the canal system, streamflow and sediment yields of the rivers; computer applications to hydrologic data; aquifer characteristics; tubewell performance; hydrology of shallow versus deep tubewells; well and well-screen design in the Indus Plain; evaluation of observed and anticipated trends in both private and public tubewell development; evaluation of water-quality programs, data analysis, and records, and computer coding of special water-quality data; and evaluation of water-level data, well discharge and specific-capacity tests and aquifer tests. The reclamation program, by pumping from tubewells, has been notably successful in lowering the water table, in providing supplemental water for irrigation and for leaching of salinized soils, and in improving crop production. Problems associated with reclamation include control of deterioration in performance of tubewells and their rehabilitation, local brackish or saline-water encroachment, and maintenance of a favorable salt balance in the groundwater system. (Woodard-USGS)
W76-06453

LOW DRIFT SPRAY NOZZLE.
Delavan Manufacturing Corp., West Des Moines, Iowa. (Assignee)
K. E. Reed.
U.S. Patent No. 3,934,823, 6 p, 13 fig, 2 ref; Official Gazette of the United States Patent Office, Vol 942, No 4, p 1789, January 27, 1976.

Descriptors: *Patents, *Waste water disposal, *Sewage effluents, *Irrigation, *Sprinkler irrigation, *Impaired water use, Irrigation practices, Water utilization, Irrigation efficiency, Application equipment, Nozzles, Fertilization, Pest control.

Low drift spray nozzles are used in the application of conventional herbicides, pesticides and other farm chemicals. Another application in which drift is critical is in irrigation type rigs in which partially treated sewage is applied to large tracts of land. Federal and local agencies have set limits in which drift must be confined to within 200-300 feet to the point of application. The method and nozzles of this invention are capable of utilizing substantially larger line pressures and yet generate large droplets which are not subject to drift. The liquid is formed in large droplets by imparting a swirling motion to the liquid in a chamber of the nozzle, passing the swirling liquid through a first orifice into another chamber of the nozzle which is larger in cross section than the orifice, and discharging the swirling liquid from the last mentioned chamber through a second orifice which is at least as large in cross section as the first orifice, whereby the discharged liquid forms a hollow geometric shape having large droplets of the liquid. (Sinha - OEIS)

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W76-06467

APPARATUS FOR SEPARATING LOW-DENSITY LIQUID FROM A RELATIVELY MORE DENSE LIQUID SUBSTANTIALLY IMMISCIBLE THEREWITH.
Erdol-Raffinerie Neustadt G.m.b.H. and Co. (West Germany); and King-Wilkinson, Inc., Tulsa, Okla. (Assignee).

K. Disque, H. Holzgen, and P. Stauch.
U.S. Patent No. 3,935,103, 7 p, 8 fig, 9 ref; Official Gazette of the United States Patent Office, Vol 942, No 4, p 1874, January 27, 1976.

Descriptors: *Patents, *Oil pollution, *Waste water treatment, *Industrial wastes, *Oil wastes, *Water quality control, Oil industry, Water pollution treatment, Water pollution control, Water pollution sources, *Separation techniques, Application equipment.
Identifiers: Tilting.

An apparatus for the removal of a relatively light or low-density liquid from a heavier or relatively high-density liquid, especially the removal of oil from water, comprises a separation vessel in which the two liquids have stratified, and a floating trough whose edges, in an uncanted position of trough, lie just above the upper surface of the low-density liquid. A discharge arrangement is connected with the trough to carry off the liquid collected and the trough is provided at its ends with a pair of floats at least one of which is internally subdivided into at least two laterally spaced trim chambers connected by a tube or passage and connected with a source of compressed or pressurized gas and the atmosphere. Trim water or another liquid is displaced from one of the chambers into the other, thereby canting the trough and bringing one of its edges below the surface of the low-density liquid so that the latter can flow into the trough and be withdrawn. When the low density liquid is present in a large quantity the height of its layer is correspondingly large and the tilting or canting angle may be correspondingly increased so that the trough is rotated about its longitudinal axis to a greater extent. When the quantity of low density liquid is less, a smaller angle of canting or rotation may be effected. (Sinha - OEIS)
W76-06473

OIL SEPARATION AND RECOVERY METHOD,
F. Gallicia.

U.S. Patent No. 3,936,377, 4 p, 9 fig, 5 ref; Official Gazette of the United States Patent Office, Vol 943, No 1, p 337, February 3, 1976.

Descriptors: *Patents, *Oil pollution, *Oil spills, Oil-water interfaces, Water pollution treatment, *Water pollution control, Water quality control, *Separation techniques, Skimming, Flow.
Identifiers: *Oil recovery, V-shaped troughs.

The oil collection and recovery device may be towed or may be propelled by a small craft or other means to skim along the surface of the water, or it may also be used in a stationary position. If towed, the inverted V-shaped troughs are designed to impact against the water and as a result of their inclined structure, the contaminated water flows downward through the water-oil interface with the oil rising to the trough vertices because of its buoyancy, and into a collection tank where further separation occurs. If the device is motionless, jets of water are used to force the oil downward along the inverted V-shaped troughs and into the separation chamber. Once in the chamber, the oil rises and is then pumped out to an oil storage means. The relatively depolluted water is forced downward by the pressure of the following liquid, through an egress duct where it is discharged from a vent forward of the inverted V-shaped troughs and below the water surface. Expelling the relatively depolluted water in this manner serves to induce a current in the oil polluted surface water causing it to flow toward the

inverted V-shaped troughs. This induced current is particularly beneficial when the device is used in the stationary position. (Sinha - OEIS)
W76-06480

MARINE DISCHARGE CONTROL APPARATUS AND METHOD FOR TREATING FLUIDS ON A MARINE VESSEL,
Keene Corp., New York. (Assignee).

I. Bartik.
U.S. Patent No. 3,937,662, 6 p, 8 fig, 4 ref; Official Gazette of the United States Patent Office, Vol 943, No 2, p 817, February 10, 1976.

Descriptors: *Filtration, Waste water treatment, *Patents, *Oil pollution, Oily water, *Oil wastes, Water pollution treatment, Water quality control, *Water pollution control, *Separation techniques, *Filters, Coalescence, Fuels, Monitoring, Turbidity, Equipment.
Identifiers: Bilge water, Ballast water, Turbidity meters.

A method and apparatus for treating bilge and ballast water in a marine vessel operates automatically to clarify the water to the point that it can be discharged overboard without further treatment. Bilge or ballast water is pumped and supplied to a number of filter units arranged in series. The filter units, which are of a special type, provide for coalescing of the admixed fluids in individual droplets of substantial size so that the oil and water conventionally making up the bilge and ballast fluid will have a strong tendency to separate by gravity. The oil thus separated from the water is drawn off from the top of one or more of the units and delivered to an oil storage tank while the water runs sequentially through the filtering and coalescing units and yields up a fraction of the oil carried in each unit and is discharged from the final one of the filtering and coalescing units as substantially oil-free water. The water from the last of the filtering units is discharged overboard but immediately upon leaving the last of the filtering units is caused to flow through a turbidity meter which senses the degree of purity of the water (the amount of oil therein) and diverts the water away from the discharge line when the turbidity of the water exceeds a predetermined allowable maximum. (Sinha - OEIS)
W76-06483

METHOD FOR DETERMINING AND CONTROLLING LIQUID COOLING SYSTEM CHARACTERISTICS.

Brown and Root, Inc., Houston, Tex. (Assignee).
C. W. Weber, C. O. Rucker, P. L. Peavy, P. W. Woo, and J. Bear.
U.S. Patent No. 3,937,973, 10 p, 5 fig, 1 ref; Official Gazette of the United States Patent Office, Vol 943, No 2, p 908, February 10, 1976.

Descriptors: *Patents, *Cooling water, Reservoirs, *Industrial water, *Cooling, *Thermal pollution, Thermal powerplants, Thermal properties, Temperature, Water pollution treatment, Water quality control, Bodies of water, Flow characteristics.
Identifiers: *Cooling systems.

Methods are described for determining and accounting for the thermal characteristics of the cooling liquid in various types of cooling systems. Using the data provided, the flow pattern of a cooling reservoir may be controlled to maximize plant efficiency under various plant load conditions and under various climatological or meteorological conditions. Moreover, temperature standards for the discharge of cooling water into natural reservoirs may be met. The flow pattern of a cooling reservoir having a surface exposed to the atmosphere is represented by a number of water segments each representing a specified time interval, preferably equal time intervals. A thermal characteristic of the segments is determined at least periodically, preferably in response to the

prevailing thermal transfer characteristics at the surfaces of the segments, and the flow pattern of the cooling reservoir is modified to accommodate the required cooling needs of the system and to prevent the discharge of cooling water into natural reservoirs if the thermal characteristics of the cooling water do not permit such discharge because of set standards. A method for at least periodically calculating the temperature of each segment from known and assumed thermal data through a trial iteration process is used. The system can also be used to determine the thermal characteristics of a natural body of water and to describe its responses to meteorological conditions. (Sinha - OEIS)
W76-06484

DECISIONS FOR DELAWARE: SEA GRANT LOOKS AT LEGAL ASPECTS OF OCS DEVELOPMENT.

Delaware Univ., Newark. Center for the Study of Marine Policy.
For primary bibliographic entry see Field 6E.
W76-06485

THE COMMON LAW OF PUBLIC NUISANCE IN STATE ENVIRONMENTAL LITIGATION.

For primary bibliographic entry see Field 6E.
W76-06488

EPA STANDARDS: HEALTH OR HEADACHE,
North Carolina Univ., Chapel Hill. Dept. of Environmental Sciences and Engineering.

For primary bibliographic entry see Field 5G.
W76-06489

EPA STANDARDS: HEALTH OR HEADACHE,
North Carolina Univ., Chapel Hill. Dept. of Environmental Sciences and Engineering.

D. W. Schnare.
American Water Works Association Journal, Vol 67, No. 9, p. 507-509 (1975). 3 p.

Descriptors: *Potable water, *Water supply, *Water quality control, *Public health, *Standards, Legal aspects, Water law, Federal government, State governments, Local governments, Governmental interrelations, Water quality, Water purification, Safety, Water quality standards, Water, Water resources, Regulation, Water pollution, Water pollution control, Water pollution abatement, Law enforcement.
Identifiers: *Safe Drinking Water Act of 1974, *National Interim Primary Drinking Water Standards.

The Environmental Protection Agency's interim primary drinking water standards require public water utilities to inform the public when any violation of a standard occurs. This requirement results in fear and confusion, and causes demand for some type of immediate action, none of which necessarily helps to achieve the goal of providing safe drinking water. A wiser plan would be to educate the public concerning the rationale behind each standard, the actual health risk involved in a violation of a standard and the means by which the water supply will be returned to compliance. Another weakness of the present policy is the prohibitive cost to local authorities of the surveillance requirements of the standards. These requirements should be reexamined to determine if their cost is justified by the potential health risk they were to be eliminated. (Nurse-Florida)
W76-06489

THE NATIONAL ENVIRONMENTAL POLICY ACTS FIRST FIVE YEARS.

National Aeronautics and Space Administration, Moffett Field, Calif. Ames Research Center.
For primary bibliographic entry see Field 6G.
W76-06490

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POLLUTION—RIGHT OF SHIPOWNER TO CONTRIBUTION FROM UNITED STATES WHERE NEGLIGENCE OF COAST GUARD WAS A CAUSE OF CASUALTY AND ENSUING SPILL. BURGESS V. THE TAMANO, 373 F SUPP 839 (D Me 1974), J.D. Kimball.
Journal of Maritime Law and Commerce, Vol. 6, No. 4, p. 665-67 (1975). 3 p.

Descriptors: *United States, *Judicial decisions, *Ships, *Oil spills, *Costs, Oceans, Oil pollution, Water pollution, Water pollution sources, Navigation, Transportation, Water, Water law, Legal aspects, Coasts, Federal government, Commercial fishing, Damages.
Identifiers: *Suits in Admiralty Act, Standing (Legal), Sovereign immunity, Negligence, Torts.

The case of *Burgess v. The Tamano* arose out of the grounding of the tanker *Tamano*, which resulted in a major oil spill. The Coast Guard subsequently undertook to contain and remove the spilled oil. In its decision, the court held that the private plaintiffs, landowners, boat owners, and commercial fishermen, had standing to maintain an action for pollution damages against the United States. The government had contended that plaintiffs were not 'maritime interests' to whom the government owed a duty of care. Rejecting this argument, the court concluded that plaintiffs were entitled to sue under the Suits in Admiralty Act, even if they were not 'maritime interests'. A second major issue in the case concerned the vessel owners' right to contribution and/or indemnity. The court, following recent decisions, held that the owners had stated a viable claim for contribution. If they successfully established the joint negligence of the United States, the owners were entitled to contribution. However, the court held that the owners' claim for indemnification had no basis either in contract or in tort. In so holding, the court agreed with a prior decision that, although the government may be liable for negligence in the performance of cleanup activities, such liability cannot be based on a theory of breach of warranty. (Schilling-Florida)
W76-06493

NEBRASKA NPDES PERMIT REGULATIONS.
In: 1974 BNA Environmental Rep. 836:0661-70 (Rules and Regs Pertaining to the Issuance of Permits Under the National Pollutant Discharge Elimination System, 1974). 10 p.

Descriptors: *Nebraska, *Permits, *Waste water disposal, *Water quality standards, *Waste disposal, Discharge(Water), Effluents, Water pollution sources, Water quality control, Waste water(Pollution), Radioactive waste disposal, Water pollution, Waste disposal, Waste treatment, Environmental effects, Administration, Administrative agencies.
Identifiers: Fact sheets, Public hearings.

Unless specifically exempted, all persons must obtain a National Pollutant Discharge Elimination System (NPDES) permit before they can discharge any pollutants from a point source into navigable waters of Nebraska. Before any final decision is made concerning the issuance or denial of the permit, the Nebraska Department of Environmental Control must make a tentative decision based upon existing standards adopted by the Environmental Control Council. Public notice containing specified information about the application and the tentative determination shall be made in a specified manner. If an applicant's potential discharge is over 500,000 gallons a day, the Department must also prepare a fact sheet describing proposed plans to be sent to any person or group upon request. After 30 days have elapsed from public notice, the Department may make its final decision. Whether a public hearing will be required before this final determination is made will depend upon attendant circumstances. If the application is

given final approval, the conditions of each issued NPDES permit must comply with minimum applicable standards adopted by the Council. (Hoffman-Florida)
W76-06495

NEVADA WATER POLLUTION CONTROL LAWS.

In: 1974 BNA Environmental Rep. 841: 0101-07 (Nev. Rev Stats, Title 40, Ch 445, Secs 445. 131 through 445.354, 1973). 7 p.

Descriptors: *Nevada, *Radioactive waste disposal, *Waste water disposal, *Water pollution control, *Permits, Effluents, Monitoring, Penalties(Legal), Waste disposal, Waste treatment, Water quality control, Water pollution sources, Discharge(Water), Waste water(Pollution), Legislation, Regulation, State governments.
Identifiers: *Pretreatment standards.

Unless specifically exempted, all persons must obtain a permit before they can lawfully discharge pollutants from a point source into any Nevada waters. The procedural steps and requirements pertaining to the application for, issuance and revocation of this permit are set forth. If the application is approved, the conditions of each permit must comply with the following: effluent limitations; standards of performance for new sources; effluent standards, effluent prohibitions and pretreatment standards; and any more stringent limitations. Any permits issued will be for a fixed period not to exceed five years, and may be renewed if specified requirements are satisfied. Set forth also are provisions for monitoring and recording discharges. When violations are detected, and they are not corrected at the request of the commission, criminal and civil sanctions may be imposed. Notwithstanding any of the above provisions, no permit may authorize the discharge of any radiological, chemical or biological warfare agent or high level radioactive waste into state waters. A permit may be obtained, however, to discharge, deposit or dispose of such wastes underground in liquid or explosive form. (Hoffman-Florida)
W76-06496

OREGON WATER QUALITY CONTROL REGULATIONS.

Oregon Dept. of Environmental Quality, Salem.
In: 1975 BNA Environmental Rep. 886:0501-26 (Ore. Ad. Rules, Ch. 340 Div. 1, Subdivisions 2 thru 8). 26 p., 14 tab.

Descriptors: *Permits, *Oregon, *Water quality control, *Waste water treatment, *Water quality standards, Thermal pollution, Legislation, Hydrogen ion concentration, Fungi, Dissolved oxygen, Radioisotopes, Basins, Streams, Streamflow, Water pollution sources, Penalties(Legal), Waste water disposal.
Identifiers: *Receiving streams.

To prevent unauthorized pollution, Oregon requires that a permit must be obtained before a person may discharge wastes into state waters. The degree of waste treatment that will be required before allowing the discharge will depend on the uses made of the receiving stream, the size of the receiving stream and the presence or absence of other sources of pollution in the same watershed. Regardless of any of these factors, the waste treatment required will always be the highest and best practicable treatment available. In addition, no wastes may be discharged if such discharge will cause any waters of the state to fail to meet general or special water quality standards. The general water standards, which are applicable to all state waters, pertain to: dissolved oxygen content, hydrogen ion concentration, fungi development, thermal limits, radioisotope concentrations, and several other specified factors. The special standards, which are applicable to particular basins throughout the state are concerned with

the same factors as the general standards; however, they will be controlling whenever there is a direct conflict. To assure compliance with all the provisions of these regulations, civil and criminal penalties are provided for any violations. (Hoffman-Florida)
W76-06497

WISCONSIN WATER POLLUTION CONTROL LAWS.

In: 1973 BNA Environmental Rep 951:0101-20 (Wisc Stats, Ch 144, as amended by Laws 1971; Ch 147, 1973). 20 p.

Descriptors: *Permits, *Wisconsin, *Water quality control, *Administrative agencies, *Waste water disposal, Regulation, State jurisdiction, Effluents, Sewage treatment, Monitoring, Public health, Administration, Water quality standards, Water resources development, Water pollution treatment, State governments, Administrative decisions.
Identifiers: Procedural requirements.

To determine the nature and extent of pollution in state waters, the Wisconsin Department of Resource Development is authorized to conduct a comprehensive water survey. The Department, which is created by this statute, shall serve as the central governmental unit in charge of protecting and improving the quality of state waters. The Department will be advised and kept abreast of local conditions and problems by newly established regional advisory boards. To achieve its statutory goals, the Department is given numerous duties and powers, including the authority to: adopt water quality standards; exercise general control over state waters; adopt rules pertaining to waste treatment facilities; and establish a water pollutant discharge elimination system (WPDES). As to the WPDES, the Department is directed to implement a permit system to control effluent discharges. The procedures for the application for, issuance and revocation of this permit are set forth. The statute also presents comprehensive regulations pertaining to: the operation of sewage disposal systems; the monitoring and inspection of all wastewater discharging facilities; and the procedural requirements relating to public hearings and public notice which are required by numerous sections of the statute. (Hoffman-Florida)
W76-06498

WISCONSIN DISCHARGE PERMITS REGULATIONS.

In: 1975 BNA Environmental Rep. 951:0501-05 (Wisc. Ad Code, Ch NR 200, 1974 as amended 1975; Ch NR 201, 1974 and Ch NR 220, 1974). 5p.

Descriptors: *Wisconsin, *Waste disposal, *Permits, Waste treatment, *Sewage effluents, Municipal wastes, Industrial wastes, Mining, Public rights, Effluents, Water pollution, Sewage disposal, *Waste water treatment, Environmental sanitation, Water quality control, Administration, Decision making.
Identifiers: *Permit systems, Point sources of pollution, Public hearings.

To protect the quality of Wisconsin waters, and in the absence of any special exemption, a permit must be obtained for the lawful discharge of any pollutant. The general filing requirements pertaining to the application for such a permit are set forth. The information contained in this application will be the basis for the denial or issuance of the permit and shall be made available to the public unless the information is designated as confidential. To aid the Environmental Protection Agency in the processing of these applications, special short form applications are available if the applicant is the owner or operator of a municipal wastewater system, agricultural operation, manufacture or mining establishment, or service, wholesale or retail establishment. If the facility will have the potential to handle 500,000 gallons of

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discharge a day, the applicant cannot use the short form and must use the applicable standard form. Before a permit may be approved for an applicant required to use the standard form, the department must prepare a fact sheet containing specified information which must be sent to interested persons on request. Finally, the regulations list 42 categories of point sources for which effluent standards and standards of performance are to be adopted. (Hoffman-Florida)

W76-06499

WISCONSIN WATER QUALITY STANDARDS.
In: 1974 BNA Environmental Rep. 951:1001-08 (Wisc. Ad. Code, Chs. N.R. 102 thru 104, 1973). 8 p.

Descriptors: *Interstate, *Water types, *Wisconsin, *Federal Water Pollution Control Act, *Water quality standards, Thermal pollution, Recreation, Water pollution sources, Water supply, Permits, Waste water disposal, Waste water treatment, Streamflow, Mixing, Water policy, Water pollution.

Identifiers: *Antidegradation, *Mixing zones.

Pursuant to the Federal Water Pollution Control Act Amendments of 1972, Wisconsin promulgated water quality standards to aid in the prevention and abatement of water pollution. To assure that water quality meets minimum requirements, several general conditions are presented which must be met by all waters at all times. In addition to these general requirements, some waters must meet additional special standards, including: (1) thermal standards; (2) standards for fish and aquatic life; (3) standards for recreational use; and (4) standards for public water supply. Furthermore, the statute presents requirements relating to antidegradation, streamflow, and mixing zones. To aid in the enforcement of all of the above standards, a permit system is initiated which will pertain to all waste water discharges. To make the above water quality standards applicable, the statute designates uses and standards for all interstate and intrastate waters. For example, Fox River is designated to be used for recreation, waste assimilation, industrial supply, fishing, and irrigation. Thus, the water quality of Fox River must meet the standards for recreational use and fish and aquatic life. Finally, with regard to intrastate waters, certain variances and additions for different districts of the state are presented. (Hoffman-Florida)

W76-06501

UTAH WATER QUALITY STANDARDS.
In: 1973 BNA Environmental Rep. 926: 0541-45 (Code of Waste Disposal Regs, Part II, 1965; as amended 1967 and 1968). 5p.

Descriptors: *Utah, *Water quality standards, *Colorado River, *Water quality control, *Classification, Upstream, Downstream, Water pollution, Legislation, Regulation, Hydrogen ion concentrations, Turbidity, Dissolved oxygen, Radioactive wastes, Biochemical oxygen demand, Beneficial uses, Economics, Social aspects.

Identifiers: *Antidegradation.

Because strict compliance with water quality standards would often allow uncontrolled pollution of exceptionally high quality waters, the state of Utah has adopted an antidegradation policy which requires that waters of a higher quality than current standards be maintained at that level. This policy may be relaxed if it can be affirmatively shown that economic and social factors make the current high quality level unrealistic. The regulation also recognizes the cumulative effects pollution may have. Thus, higher quality standards will generally be set for upstream waters than for downstream waters. No wastes may be discharged into state waters if such discharge would violate specific standards pertaining to the water body's classification. These standards, which vary for dif-

ferent classes of water, pertain to: radioactive limitations; hydrogen ion concentrations; organic chemical limitations; coliform limitations; dissolved oxygen; turbidity; and biochemical oxygen demand. An appendix to this statute presents guidelines for formulating water quality standards for the interstate waters of the Colorado River system. Because these waters are used for numerous purposes, maximum effort should be made to maintain the highest possible water quality level. To achieve this goal, provisions are presented pertaining to minimum quality criteria applicable to interstate waters at agreed state line sampling points. (Hoffman-Florida)

W76-06503

WASHINGTON WATER POLLUTION CONTROL LAWS.

In: 1973 BNA Environmental Rep. 941:0101-16 (Wash. Rev. Code, Ch. 90.48, amended by Laws 1971 and 1973; Ch. 90.50, 1971; Ch. 90.52, 1971 and Ch. 90.54, 1971). 16p.

Descriptors: *Washington, *Water pollution control, *Waste water disposal, *Permits, *Federal Water Pollution Control Act, Ecology, Economics, Waste treatment, Government finance, Effluents, Water quality standards, Watersheds(Basins), Facilities, Water pollution sources, Pollutants, Discharge(Water).

Identifiers: *Waste disposal systems.

To insure the purity of all state waters, the Washington water pollution control commission is directed to set up a comprehensive water pollution control program. As part of this program, the commission is authorized to set quality standards for all state waters and for substances discharged therein. Since the discharge of substances has been a major factor in water pollution, all persons must obtain a permit before they can lawfully discharge polluting substances into state waters. A permit must also be obtained before any person may operate a waste disposal system. The procedural requirements and steps involved in the application, issuance, and revocation of these permits are set forth. Because of the necessarily broad scope of an effective water pollution program, the commission is also given the powers to delineate and establish sewage drainage basins, to financially assist eligible recipients in the construction of water pollution control facilities, and to thoroughly investigate any incidents involving the unauthorized entry of oil into state waters. This statute also creates the department of ecology to serve as the State Water Pollution Control Agency for all purposes of the Federal Water Pollution Control Act (FWPCA). The department is authorized to participate in any programs of the FWPCA which will result in benefits to the state. (Hoffman-Florida)

W76-06504

WASHINGTON WASTE WORKS REGULATIONS.

In: 1973 BNA Environmental Rep. 941:0581-85 (Wash. Ad. Code, Ch. 372-20). 5 p.

Descriptors: *Washington, *Sewage treatment, *Design data, *Permits, *Design standards, Facilities, Waste treatment, Construction materials, On-site tests, Monitoring inspection, Industrial wastes, Municipal wastes, Water supply, Topography, Legislation.

Identifiers: *Pump stations.

Because sewerage systems are continually being expanded, approval of a municipal sewerage system may be obtained from The Washington State Pollution Control Commission without the submission of detailed plans. However, the municipality must obtain approval of a report containing general layout map and construction specifications of the system. This layout map shall include the following items: boundaries; existing and proposed sewers; existing and proposed pump sta-

tions; topography and elevations; bodies of water; and public water supplies. Sewerage treatment works are generally built to meet a specific need. Consequently, before approval will be granted for its construction, an engineering report must be submitted. Because this report contains basic design data, and forms the basis for the preparation of the construction drawings, it will allow the commission to make an intelligent evaluation of the proposed project. To insure compliance with approved designs, the commission must make adequate and competent inspections during the construction period. Once the construction is complete and operation has begun, the owner must keep adequate records and must make such tests as are necessary to assure that the plant is operating at its highest practical efficiency. The statute also presents provisions pertaining to the construction and operation of industrial waste treatment works. (Hoffman-Florida)

W76-06507

WASHINGTON WATER POLLUTION CONTROL PLANNING REGULATIONS.

In: 1973 BNA Environmental Rep. 941: 0701-05 (Wash. Ad. Code, Ch. 372-68). 5 p., 2 map.

Descriptors: *Washington, *Water quality control, *Planning, Watersheds(Basins), *Project planning, Administration, Water management(Apply), Administrative agencies, Capital costs, Facilities, Economics, Coordination, Legislation, Regional development, Environment.

Identifiers: Public hearings.

To insure a high quality of state water the Washington legislature has promulgated regulations pertaining to water pollution control and abatement plans for sewage drainage basins. The initial drainage basin plan will be prepared by the planning agencies having authority over a particular basin. This plan should include the following: (1) a statement of the purpose of the plan and a summary of its findings; (2) the basis for planning, such as a description of the physical environment and projected social and economic growth; (3) an inventory of existing facilities and sources and characteristics of wastes; (4) a description of present and future water pollution control needs; (5) a capital improvements program; (6) format and updating; and (7) other pertinent plan considerations. Once a plan has been prepared, it must be presented to the water pollution control commission for approval. If the commission tentatively approves the plan, a public hearing must be held to allow the public the opportunity to make oral statements. After this public hearing, the commission may make its final decision. If the plan subsequently requires amendment, specified procedures must be followed. (Hoffman-Florida)

W76-06508

WASHINGTON HEARINGS REGULATIONS.

For primary bibliographic entry see Field 6E.

W76-06509

WASHINGTON NPDES PERMIT PROGRAM REGULATIONS.

In: 1974 BNA Environmental Rep. 941:0781-88 (Wash. Ad. Code, Ch. 173-220, 1974, as amended 1974). 8 p.

Descriptors: *Washington, *Discharge(Water), *Permits, *Water quality control, *Water quality standards, State governments, Effluents, Water pollution sources, Administration, Administrative agencies, Legislation, Radioactive waste disposal, Waste water(Pollution), Environmental effects, Waste disposal, Waste water disposal.

Identifiers: *National Pollutant Discharge Elimination(NPDES), Permit, Public notice, Public hearings.

Unless specifically exempted, all persons must obtain a state National Pollutant Discharge Elimina-

tion System (NPDES) permit before they can discharge any pollutants from a point source into navigable waters of the state of Washington. Before any final decision is made concerning the issuance or denial of the permit, the Department of Ecology must make a tentative determination based upon proposed standards set forth in the application. Public notice containing information about applications and the tentative determination shall be made in a specified manner. If an applicant's potential discharge is over 500,000 gallons per day, the Department must also prepare a fact sheet describing the proposed plans to be sent to any person upon request. After allowing 30 days for the receipt of public comments, the Department may make its final decision. Whether a public hearing will be required before this final decision is made will depend on attendant circumstances. If the permit application is given final approval, the conditions of each issued NPDES permit must comply with applicable effluents limitations and water quality standards. (Hoffman-Florida)

W76-06510

WASHINGTON WATER QUALITY STANDARDS.

In: 1974 BNA Environmental Rep. 941:1001-09 (Wash. Ad. Code, Ch 173-201, 1973, as amended 1973). 9 p, 1 tab.

Descriptors: *Water types, *Washington, *Water quality control, *Classification, *Water quality standards, Dissolved oxygen, Coliforms, Turbidity, Temperature, Hydrogen ion concentration, Radioactive wastes, Aesthetics, Toxins, Permits, Pollutants, Administration, Legislation, State governments, Penalties(Legal), Waste water disposal.

Identifiers: *Water classification.

In order to establish a comprehensive water quality program, all Washington state waters shall be classified as Class AA (extraordinary), Class A (excellent), Class B (good), Class C (fair), or Lake Class. Each of these classes will have specified requirements pertaining to the following water quality criteria: total coliform organisms; dissolved oxygen; total dissolved gas; temperature; hydrogen ion concentration; turbidity; toxic, radioactive, or deleterious material concentrations; and aesthetic values. With these requirements as a basis, state waters are classified in one of the above five classes. Thus, if a particular river is classified as Class B, all necessary steps must be taken to insure that the river meets Class B requirements. A list of all state waters, and their classifications are presented. To help enforce this program, the Department of Ecology shall set up a permit system to control the discharge of polluting substances. A surveillance program is authorized to ascertain whether the conditions of any issued permits are being followed. The department is also given the power to issue regulatory notifications, orders, and directives to any person who is, in the department's opinion, polluting or about to pollute state waters. Civil and criminal penalties are provided for the violation of any of the provisions of the statute. (Hoffman-Florida)

W76-06511

WATER QUALITY STANDARDS--COLORADO RIVER SYSTEM (SALINITY CONTROL POLICY AND STANDARDS PROCEDURE).

Environmental Protection Agency, Washington, D. C.

39 Fed. Reg. 43721-23 (1974). 3 p.

Descriptors: *Adoption of practices, *State governments, *Colorado River Basin, *Water quality standards, *Salinity, Arizona, California, Colorado, Nevada, New Mexico, Utah, Wyoming, Federal Water Pollution Control Act, Salts, Streams, Drainage area, Diversion, Standards, Irrigation, Agriculture, Management, Abatement.

This notice sets forth a policy of maintaining salinity concentrations in the Colorado River System at or below 1972 average levels. It also requires the Colorado River System states to promulgate water quality standards and a plan for meeting the standards. The first step will be the establishment of procedures within thirty days of the effective date of these regulations for the adoption on or before October 18, 1975, of water quality standards for salinity including numerical criteria and an implementation plan for salinity control. The goal of the plan shall be to achieve compliance with the adopted standards by July 1, 1983. Comments and suggestions of interested parties are summarized, as well as specific objections of the Sierra Club to the proposed regulation. (Segall-Florida)

W76-06512

EFFLUENT GUIDELINES -- STEAM ELECTRIC POWER GENERATING POINT SOURCE CATEGORY.

Environmental Protection Agency, Washington, D. C.

40 Fed. Reg., 7095-96 (1975). 2 p.

Descriptors: *Power system operation, *Waste water(Pollution), *Discharge(Water), *Recirculated water, *Regulation, Waste treatment, Waste water disposal, Water quality control, Water quality standards, Administration, Administrative agencies, Water pollution sources, Industrial wastes, Industrial water, Wastes, Environmental control.

Identifiers: Administrative regulations.

The Environmental Protection Agency herein amends and corrects subparts A through D of its Steam Electric Power Generating Point Source Category regulations. 'Blowdown' is defined as the minimum discharge of recirculating water for the purpose of discharging materials contained in the process, the further buildup of which would cause concentrations or amounts exceeding limits established by best engineering practice. 'Low volume waste source' is defined as waste water from all sources except those for which specific limitations are otherwise established. 'Recirculated cooling water' is defined as water which is first passed through the main cooling condensers for the purpose of removing waste heat from the generating unit, then through a cooling device for the purpose of removing such heat from the water, and finally passed again, except for blowdown, through the main cooling condensers. Various editorial and typographical errors are likewise corrected. (Welch-Florida)

W76-06513

INORGANIC CHEMICALS MANUFACTURING POINT SOURCE CATEGORY.

Environmental Protection Agency, Washington, D. C.

40 Fed. Reg. 7106-09 (1975). 4 p.

Descriptors: *Waste water(Pollution), *Waste disposal, Pollutants, *Federal Water Pollution Control Act, *Discharge measurement, Cooling water, Streams, Effluents, Permits, Rainfall, Runoff, Equipment, Industries, Data collections, Chemicals, Pollutant identification, Pollution abatement.

Identifiers: Contaminated non-process waste water, Process waste water, Point sources.

Amendments are proposed to the Inorganic Chemicals Manufacturing Point Source Category. The affected portions are Chlorine and Sodium or Potassium Hydroxide Production Subcategory, Hydrochloric Acid Production Subcategory, Nitric Acid Production Subcategory, Sodium Dichromate and Sodium Sulfate Production Subcategory, Sodium Metal Production Subcategory, Sodium Silicate Production Subcategory, and Sulfuric Acid Production Subcategory. Previously, point sources in these categories were required to

achieve no discharge of 'process waste water pollutants'. Now it appears that the existing definition of process waste water may be overly broad since it can be construed to apply to waste streams other than those directly connected with the production effort. Accordingly the Environmental Protection Agency is proposing to add to these subparts a definition of 'contaminated non-process waste water' for the purpose of distinguishing between those pollutant bearing streams that are attributable to production and those ancillary streams that are not. The Agency has identified four ancillary sources of pollution from plants which should be controlled by available technology to which a no-discharge standard will not always be appropriate. The four sources and associated limitations on pollutant discharge are specified in the proposed amendments. (Segall-Florida)

W76-06514

TIRE AND SYNTHETIC SEGMENT OF THE RUBBER PROCESSING POINT SOURCE CATEGORY.

Environmental Protection Agency, Washington, D. C.

40 Fed. Reg. 7109-10 (1975). 2 p.

Descriptors: *Classification, *Water quality control, *Waste water disposal, *Waste water treatment, *Federal Water Pollution Control Act, *Effluent streams, Water quality standards, Water pollution control, Water pollution sources, Waste disposal, Water resources, Regulation, Administrative agencies, Administration, United States.

Identifiers: Administrative regulations.

Pursuant to the Federal Water Pollution Control Act, as amended, the Environmental Protection Agency herein proposes amendments to the effluent limitations and guidelines for existing sources, and standards of performance and pretreatment standards for new sources, for the tire and synthetic segment of the rubber processing point source category. The regulation clarifies which process waste water streams should be regulated, and distinguishes between process and nonprocess waste water streams in tire and inner tube plants constructed before 1959 which were not designed to segregate process waste water and nonprocess waste water. 'Process waste water' is defined as discharges from: soapstone solution applications; stream cleaning operations; air pollution control equipment; unroofed process oil unloading areas; mold cleaning operations; latex applications; and air conditioner receivers. A provision of the proposed regulation would control the concentration of oil and grease in nonprocess waste water for tire and inner tube plants constructed prior to 1959. (Welch-Florida)

W76-06516

SOAP AND DETERGENT MANUFACTURING CATEGORY (PRETREATMENT STANDARDS FOR INCOMPATIBLE POLLUTANTS).

Environmental Protection Agency, Washington, D. C.

40 Fed Reg 7580-83 (1975). 4 p.

Descriptors: *Chemical oxygen demand, *Detergents, *Standards, *Treatment facilities, *Organic wastes, Federal Water Pollution Control Act(FWPCA), Pollutants, Waste water(Pollution), Discharge measurement, Oxygen, Degradation(Decomposition), Alcohols, Statistical methods, Construction, Design, Recycling, Evaluation, Biochemical oxygen demand.

Identifiers: *Discharge streams.

The Environmental Protection Agency (EPA) has proposed regulation concerning the revision of pretreatment standards for new sources. The proposal will supplant portions of the Soap and Detergent Manufacturing Point Source Category, establishing for the manufacture of certain detergents therein the standards of pretreatment for new sources which discharge to publicly owned

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treatment works. After evaluations of information relevant to the discharge of waste waters of the soap and detergent manufacturing industry to publicly owned treatment works, the EPA proposes the following modifications to the pretreatment standards for new sources in the industry: (1) parameters and limitations will be referenced to the discharge stream from the affected source within a subcategory, not to finished products; (2) requirements for pretreatment will be defined in terms of a ratio of chemical oxygen demand (COD) to biochemical oxygen demand (BOD) of the discharge streams, as defined in the regulations and amendments; and (3) for waste streams with COD/BOD7 ratios greater than ten and COD content above specified levels, the pretreatment standards shall be as specified in this notice. (Segall-Florida) W76-06517

EFFLUENT GUIDELINES AND STANDARDS - FERROALLOYS MANUFACTURING POINT SOURCE CATEGORY.

Environmental Protection Agency, Washington, D.C.
40 Fed Reg 8030-37 (1975) 8 p.

Descriptors: *Effluents, *Discharge(Water), *Waste water disposal, *Water quality control, *Federal Water Pollution Control Act, Regulation, Administrative agencies, Administrative decisions, Industrial wastes, Industrial water, Environmental control, Water quality standards, Wastes, Waste dilution, Water pollution control, Industrial plants, Pollutants.
Identifiers: Administrative regulations.

Pursuant to the Federal Water Pollution Control Act, as amended, the Environmental Protection Agency herein establishes effluent limitations and guidelines for existing sources and standards of performance and pretreatment standards for new sources for the ferroalloy manufacturing point source category. The regulation provides control standards for the discharge of pollutants which reflect the greatest degree of effluent reduction which the agency determines to be achievable. The calcium carbide and electrolytic ferroalloys segments of the ferroalloys industry are divided into subcategories on the basis of water uses, waste control technologies, and waste water constituents. For each subcategory effluent limitations and standards of performance are established. An economic impact analysis revealed that the modest cost increases generated by compliance with the guidelines can be passed on without significantly affecting product demand and employment. (Welch-Florida) W76-06518

FERROALLOY MANUFACTURING POINT SOURCE CATEGORY.

Environmental Protection Agency, Washington, D.C.
40 Fed. Reg. 8038-41 (1975). 4 p.

Descriptors: *Federal Water Pollution Control Act, *Waste disposal, *Water pollution control, *Pollutants, *Effluents, Waste disposal, Environmental effects, Regulation, Legislation, Water quality, Administrative agencies, Adoption of practices, Waste water(Pollution), Federal government, Sewage treatment, Treatment facilities, Environmental control, Treatment.
Identifiers: Administrative regulation.

The Environmental Protection Agency has proposed amendments to Chapter 40 of the Code of Federal Regulations concerning effluent limitations and guidelines for existing sources and standards of performance and pretreatment standards for new sources for the ferroalloys manufacturing point source category. The proposed amendment will add a 'covered calcium carbide furnaces with wet air pollution control devices' subcategory to the other calcium carbide furnaces subcategories.

Section 307(b) of the Federal Water Pollution Control Act requires such regulation standards for pollutants introduced into publicly owned treatment works, and federal regulations require that EPA propose such specific pretreatment standards at the time effluent limitations are established for point source discharges. The amendment includes both pretreatment standards for existing and new source discharges and standards of performance for new source discharges. The pretreatment regulation proposed applies to the introduction of pollutants which are directed into a publicly owned treatment works rather than those discharged into navigable waters. (Welch-Florida) W76-06519

EFFLUENT LIMITATIONS AND GUIDELINES - PRINTING INK FORMULATING POINT SOURCE CATEGORY.

Environmental Protection Agency, Washington, D.C.
40 Fed. Reg. 8307-11 (1975). 5 p.

Descriptors: *Federal Water Pollution Control Act, *Landfills, *Classification, *Waste treatment, *Waste water treatment, Regulation, Solid wastes, Liquid wastes, Water pollution sources, Water quality control, Legislation, Navigable waters, Waste disposal, Ultimate disposal, Economics, Environmental control, Energy disposition.
Identifiers: *Printing ink, *Liquid concentrates.

Pursuant to the Federal Water Pollution Control Act, the Environmental Protection Agency (EPA) is publishing proposed regulations concerning the oil-base ink subcategory and water-base ink subcategory of the printing ink formulating point source category. The printing ink category was divided into these subcategories primarily because of differences in their waste water treatability. The EPA found that the best practicable control technology currently available for both subcategories is no discharge of waste water pollutants into navigable waters. The most commonly employed systems by which the standard is obtained in each subcategory is presented. The best available and practicable control technology also requires that pollutants removed from waste water be disposed of in the form of solid wastes and liquid concentrates. Although most of the pollutants removed are non-hazardous some are hazardous; therefore, special care should be taken when selecting landfill sites. The precautions and factors that should be considered in making such site selection are presented. Provisions are also set forth relating to the impact of these regulations on cost estimates; energy requirements; environmental control; standards of performance for new sources; and pretreatment standards for new sources. (Hoffman-Florida) W76-06520

NONFERROUS METALS MANUFACTURING POINT SOURCE CATEGORY.

Environmental Protection Agency, Washington, D.C.
40 Fed Reg 8514-29 (1975). 16 p, 14 tabs.

Descriptors: *Waste water treatment, *Classification, *Federal Water Pollution Control Act, *Copper, *Water quality standards, Legislation, Copper compounds, Wastes, Discharges(Water), Pollutants, Waste water disposal, Waste treatment, Waste disposal, Waste water(Pollution), Regulation, Administrative agencies, Effluents.
Identifiers: *Nonferrous metals, Point source pollution.

Pursuant to the Federal Water Pollution Control Act, the Environmental Protection Agency (EPA) has promulgated effluent limitations and guidelines for existing sources for the primary copper smelting subcategory, the primary copper refining subcategory, the secondary copper sub-

category, the primary lead subcategory, and the primary zinc subcategory of the nonferrous metals manufacturing point source category. The EPA is also proposing standards of performance and pretreatment standards for the above subcategories. The general methodology used in developing these limitations, guidelines and standards are set forth. Provisions pertaining to the waste characteristics and to the origin of waste water pollutants of each of the subcategories are also set forth. Finally, the regulations contain effluent limitations guidelines representing the degree of effluent reduction attainable by the application of the best available technology economically achievable and effluent limitations guidelines representing the degree of effluent reduction attainable by the application of the best practicable control technology currently available. (Hoffman-Florida) W76-06521

INTERIM PRIMARY DRINKING WATER STANDARDS.

Environmental Protection Agency, Washington, D.C.
40 Fed. Reg., 11990-98 (1975). 9 p, 5 tab.

Descriptors: *Potable water, *Water quality standards, *State governments, Analytical techniques, *Water supply development, Organic compounds, Inorganic compounds, Coliforms, Turbidity, Pesticides, Sampling, Administrative agencies, Federal jurisdiction, State jurisdiction, Pollutants, Regulation, Legislation, Water supply, Analysis, Federal government.
Identifiers: *Safe Drinking Water Act.

As the first step in the implementation of the Safe Drinking Water Act (SDWA), the Environmental Protection Agency (EPA) is proposing regulations setting forth interim primary drinking water standards. These standards set maximum contaminant levels for the following: inorganic chemicals; organic chemicals; pesticides; turbidity; and coliforms. To insure compliance with these standards, provisions are presented concerning sampling and analytical requirements for each of the above contaminants. In addition, the regulations set forth reporting requirements concerning the results of these analytical tests. The SDWA not only provides for the promulgation of water standards, but also provides for the promulgation of siting requirements concerning the location of new or expanded water supply systems. The EPA, however, does not have a veto power over the location of such systems, although state agencies may have such a power. Despite the above standards and requirements, the primary responsibility for the implementation of the Act will rest with individual states, rather than with the federal government. Thus, when the state demonstrates the ability to effectively implement the Act, the federal government will play only a passive role. (Hoffman-Florida) W76-06522

NAT. RES. DEF. COUNCIL V. TRAIN. (FEDERAL WATER POLLUTION ACT AMENDMENTS).

For primary bibliographic entry see Field 6E.
W76-06523

STOCK V. STATE (CONSTITUTIONALITY OF STATE ENVIRONMENTAL CONSERVATION ACT).

For primary bibliographic entry see Field 6E.
W76-06525

STATE EX REL STATE GAM COMM'N V GOLD HILL IRR. DIST. (NO LIABILITY FOR RELEASING AQUATIC SOLVENT INTO CANALS WHICH OVERFLOWED CAUSING FISHKILL).

For primary bibliographic entry see Field 6E.
W76-06529

UNITED STATES V KENECOTT COPPER CORP (VIOLATION OF STATUTORY REQUIREMENT TO IMMEDIATELY REPORT OIL DISCHARGE INTO NAVIGABLE WATERS).
For primary bibliographic entry see Field 6E.
W76-06541

COGNITIVE STRAWMAN: PUBLIC INPUT TO A WATER RESOURCE PLANNING SYSTEM, Utah State Univ., Logan. Technical Committee of the Water Resources Research Centers of the Thirteen Western States.
For primary bibliographic entry see Field 6B.
W76-06548

REORIENTATION OF URBAN WATER RESOURCES RESEARCH, FINAL REPORT, Rutgers-The State Univ., New Brunswick, N.J. Water Resources Research Inst.
For primary bibliographic entry see Field 6B.
W76-06553

REORIENTATION OF URBAN WATER RESOURCES RESEARCH, EXECUTIVE SUMMARY, Rutgers-The State Univ., New Brunswick, N.J. Water Resources Research Inst.
For primary bibliographic entry see Field 6B.
W76-06554

ENVIRONMENTAL ASSESSMENT AND DESIGN: PROCEEDINGS OF A SEMINAR, Minnesota Univ., Minneapolis. Water Resources Research Center.
For primary bibliographic entry see Field 6G.
W76-06555

FEDERAL ENVIRONMENTAL IMPACT STATEMENTS—A CASE STUDY, Army Engineer District, St. Paul, Minn.
For primary bibliographic entry see Field 6G.
W76-06557

MULTIVARIATE AND SEQUENTIAL STATISTICAL PROCEDURES IN THE BIOLOGICAL ASSESSMENT OF WATER QUALITY, Colorado State Univ., Fort Collins. Dept. of Statistics.
For primary bibliographic entry see Field 5A.
W76-06561

EVALUATION OF POLLUTION ABATEMENT TECHNIQUES APPLICABLE TO LOST CREEK AND BROWN'S CREEK WATERSHED, WEST VIRGINIA. Ackenheil and Associates Geo Systems, Inc., Pittsburgh, Pa.
Available from the National Technical Information Service, Springfield, Va. 22161 as PB-242 722. \$6.00 in paper copy, \$2.25 in microfiche. Prepared for the Appalachian Regional Commission, Washington, D.C. October 31, 1973. 146 p, 5 fig, 11 tab.

Descriptors: Water quality, *Acid mine water, *Coal mine wastes, Water pollution control, *Reverse osmosis, *Environment impact, *Alternative planning, Acidic water, Pollutants, Water pollution treatment, *West Virginia, *Pollution abatement, Watersheds(Basins).
Identifiers: Lost Creek(WV), Brown's Creek(WV), Hamson County(WV), Clark-sburg(WV).

This study is one of a series of reports concerning the development of an overall environmental pollution abatement plan for the Monongahela River Basin. Primary objectives are to evaluate applicable pollution reduction methods and provide

recommendations as to least cost and best overall solutions to mine drainage problems. Study results are based on water quality data from previous investigations and on supplementary data gathered during this study. Conclusions are: that water quality of the creeks has improved significantly; that the 4 identified drainage sources discharge 4800 lbs/day acid load and 600 lbs/day iron load to the principal streams; that conventional surface reclamation and treatment are methods best suited for abatement; that a least cost abatement plan has been developed which would provide an 80% reduction in acid and iron loads; and that a long term plan of abatement has been developed which considers associated long-range environmental benefits such as 90% reduction in acid and iron loads, a reverse osmosis facility, a sewage treatment plant and aesthetic improvements in other areas of the watersheds. Primary recommendations are: that a program be implemented as soon as practical to perform the described surface reclamation work in accordance with established priorities; that a program to secure funds and obtain preliminary design data for treatment plant possibilities be started with emphasis placed on pursuing the long term plan for the watershed. (Salzman-North Carolina)
W76-06570

DEVELOPMENT OF A PRIORITY DETERMINATION PROCEDURE. Rivkin/Carson, Inc., Washington, D.C.; and Edwards (Arthur) Associates, Washington, D.C.
Available from the National Technical Information Service, Springfield, Va. 22161 as PB-242 669, \$5.25 in paper copy, \$2.25 in microfiche. Prepared for the Appalachian Regional Commission, Washington, D.C., March 1972. 115 p, 11 fig, 4 append. 14010-HOC-1.

Descriptors: *Mine drainage, *Economic impact, *Pollution abatement, *Priorities, Methodology, *Decision making, Watershed management(Applied), *Investment, Water pollution control, Air pollution, Soil contamination, River basin development, Environment, Maryland, Pennsylvania, West Virginia.
Identifiers: *Monongahela River Basin(MD PA WV).

This study of the Monongahela River Basin in MD, PA and WV gives a procedure for developing rankings of environmental problems. A central idea is that although pollution abatement aims at improving environmental quality, it is also a project to help stimulate the local economy. There are several basic objectives: abatement project investments should support economic development; projects are selected on the basis of contribution toward designated standards; and strategies and fund allocation must be viewed to ensure general environmental improvement at a given site; investment must be selective in order to achieve the most at the least cost; investment will be made where more rather than fewer people are affected, the economy is stronger, growth is anticipated, and where public investments are ongoing; and laws must be recognized. Because pollution is concentrated in some areas and not others, the region was divided into pollution abatement zones which are the primary units for assessing pollution and investment. After a given amount of money is assigned to a zone, priorities are given which will maximize benefits within that zone. Sub-basins and county areas were used for socio-economic analysis and administrative areas, respectively. The procedural steps are: (1) inventory information on pollution, the economy, other abatement attempts; (2) measure and assign values to pollution within pollution abatement zones, to the importance of abatement, and to the effort; (3) composite rating of pollution abatement zones and an assessment of the relative importance of illegal pollution; (4) project identification; (5) selection of projects. (Smith-North Carolina)
W76-06571

ANNUAL REPORT 1974. Lehigh-Northampton Counties Joint Planning Commission, Lehigh Valley, Pa.
For primary bibliographic entry see Field 6B.
W76-06572

ENVIRONMENTAL MANAGEMENT FOR THE METROPOLITAN AREA CEDAR-GREEN RIVER BASINS, WASHINGTON, PART II: URBAN DRAINAGE. Army Engineer District, Seattle, Wash.
For primary bibliographic entry see Field 6G.
W76-06573

KANEOCHE ALTERNATIVES: AN APPLICATION OF IMPACT METHODOLOGY. Hawaii Environmental Simulation Lab., Honolulu.
For primary bibliographic entry see Field 6G.
W76-06574

SUMMARY AND CONCLUSIONS: NUTRIENT TRANSPORT AND ACCOUNTABILITY IN THE LOWER SUSQUEHANNA RIVER BASIN, Environmental Protection Agency, Annapolis, Md. Annapolis Field Office.
For primary bibliographic entry see Field 5B.
W76-06575

THE DISTRIBUTIONAL ECOLOGY AND DIVERSITY OF BENTHIC INSECTS IN CEMENT CREEK, COLORADO, Maryland Univ., College Park. Md. Dept. of Zoology.
For primary bibliographic entry see Field 2I.
W76-06587

NORTHERN GREAT PLAINS RESOURCE PROGRAM, WATER WORK GROUP REPORT. Northern Great Plains Resources Program, Denver, Colo.
For primary bibliographic entry see Field 3E.
W76-06616

CORRECTIVE TAXES FOR POLLUTION CONTROL: AN APPLICATION OF THE ENVIRONMENTAL PRICING AND STANDARDS SYSTEMS TO AGRICULTURE, California Univ., Santa Cruz. Dept. of Economics. L. W. Abrams, and J. L. Barr.
Journal of Environmental Economics and Management, Vol. 1, p. 296-318, 1974. 6 fig., 11 tab., 2 ref.

Descriptors: *Pollution taxes(Charges), *Tax rates, *Fertilizers, *Efficiencies, Linear programming, Mathematical models, Nitrogen, Nitrates, Agriculture, Costs, Illinois, Water quality standards, Pollution abatement.
Identifiers: *Environmental Pricing and Standards, Point-source pollutants, Dispersed-source pollutants.

The Environmental Pricing and Standards System (EPS), a corrective tax approach to managing environmental quality which avoids the problem of constructing the social damage function by not requiring fully Pareto efficient solutions, is applied to the problem of managing surface water nitrate pollution in agricultural regions. Regression analysis is used to relate nitrogen fertilizer use to nitrate concentration found in Illinois waters. These relationships enable the regional environmental nitrate-nitrogen standards to be translated into constraints on agricultural production. A mathematical programming model translates the environmental constraints and Illinois production alternatives into the national agricultural market. Cost minimizing production patterns and optimal nitrogen application rates are determined using linear programming techniques. Nitrogen use is constrained, and the optimal shadow prices on these constraints can be interpreted as the cor-

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rective taxes on nitrogen fertilizer which are necessary to achieve specific environmental standards. The effect that application of the EPS approach would have on land use, production, prices and income are examined for both Illinois farmers and the nation. Results indicate that corrective taxes of 1-2 cents per pound would be needed to achieve the U.S. Public Health Service standard of 10 ppm. (Luedtke-Wisconsin). W76-06618

STABILITY ANALYSIS OF AN EFFLUENT CHARGE AND THE 'POLLUTERS PAY' PRINCIPLE

Louvain Univ. (Belgium).
H. Tulkens, and F. Schoumaker.
Journal of Public Economics, Vol. 4, No. 3, p. 245-269, 1975. 4 fig., 15 ref. NSF GS-3269-A2.

Descriptors: *Pollution taxes (Charges), Optimization, Effluents, Mathematical studies, Compensation, Pollution abatement.
Identifiers: Stability analysis, Pigovian taxes, Pareto optimum, Externalities.

Problems relating to the control of a detrimental externality affecting many agents through a Pigovian tax are considered. Under conditions of a pure exchange economy with two private commodities and one collective externality, a non-attainment process is formulated which yields a rule for adjusting an effluent charge of the Pigovian type from the zero level at a laissez-faire equilibrium up to a Pareto optimum. Convergence, monotonic decrease of the externality along a continuous path of price equilibria, and the distributional implications of alternative redistribution schemes for the proceeds of the charge are analyzed. Various interpretations of the 'polluters pay' principle are also discussed in conjunction with property rights. The stability analysis methodology developed by Dreze, de la Vallée Poussin, and Malinvaud in recent literature on the theory of public goods is utilized with two variations: (1) The quality of public good is controlled by means of a price, the Pigovian tax, instead of being directly planned, and (2) the economy always remains within feasible states, along the process. The analysis is limited to the simplest case for reasons of expositional clarity, but possible extensions of the process are also briefly discussed. (Luedtke-Wisconsin). W76-06623

ECONOMIC ANALYSIS OF EFFLUENT GUIDELINES FOR THE ASBESTOS INDUSTRY

Little (Arthur D.), Inc., Cambridge, Mass.
Available from the National Technical Information Service, Springfield, Va. 22161, as PB-238 268, \$5.50 in paper copy, \$2.25 in microfiche. Report No. EPA-230/2-74-001, December 1974. 112 p. 19 fig., 26 tab., 27 append. 60-01-1541.

Descriptors: *Economic impact, *Water pollution control, *Mineral industry, *Asbestos, Prices, Industrial production, Employment, Foreign trade, Costs, Pollution abatement, Industrial wastes, Effluents, Legislation.
Identifiers: *Asbestos industry.

The potential economic impact of water pollution abatement requirements on the asbestos products manufacturing industry under the Federal Water Pollution Control Amendments Act of 1972 for three standards: (1) The best practicable control technology (BPT), (2) the best available control technology (BAT), and (3) the new source performance standards (NSPS), is evaluated. Broad economic effects including prices, continued viability of affected plants, employment, industry growth, and foreign trade are considered. Capital costs for the entire industry to meet the 1977 BPT standards are estimated to be \$2,928,000 or less than 1.8% of the estimated annual sales of the asbestos products. This is not expected to be a

major burden on the industry, though it is possible that three plants could be forced to shut down. BAT standard implementation would require a total capital expenditure of about \$6,510,000, with one additional plant closing possible. Analysis of the impact of NSPS indicates that there would be no adverse effects on the growth of the industry due to the standards, that price structure and market competitiveness would not be significantly affected, and that these costs would not constitute a significant inducement for U.S. manufacturers to locate new facilities at foreign sites. (Luedtke-Wisconsin). W76-06626

ECONOMIC ANALYSIS OF EFFLUENT GUIDELINES. THE NONFERROUS METALS INDUSTRY (ALUMINUM)

Little (Arthur D.), Inc., Cambridge, Mass.
Available from the National Technical Information Service, Springfield, Va. 22161, as PB-239 161, \$6.25 in paper copy, \$2.25 in microfiche. Report No. EPA-230/2-74-018, August 1974. 150 p. 8 fig., 46 tab., append. 68-01-1541.

Descriptors: *Economic impact, *Water pollution control, *Mineral industry, *Aluminum, Prices, Industrial production, Employment, Foreign trade, Air pollution, Costs, Pollution abatement, Industrial wastes, Effluents, Legislation, Standards.
Identifiers: *Aluminum industry, Bauxite refining industry.

The potential economic impact of pollution abatement requirements under the Federal Water Pollution Control Amendments Act of 1972 for three standards: (1) Best practicable control technology (BPT), (2) best available control technology (BAT), and (3) new source performance standards (NSPS), is evaluated for the aluminum industry. Broad economic effects including product price increases, continued viability of affected plants, employment, industry growth and foreign trade are considered. In the primary aluminum industry, the trend toward the use of dry scrubbers for air pollution control at an annual cost of about .01 W76-06627

A GUIDE TO WISCONSIN'S LAKE MANAGEMENT LAW

Wisconsin Univ. Extension, Madison.
For primary bibliographic entry see Field 6E.
W76-06632

LAKE MANAGEMENT CONFERENCE, MAY 12-14, 1975

Purdue Univ., Lafayette, Ind. Water Resources Research Center.
For primary bibliographic entry see Field 4A.
W76-06642

INFRARED DRY CAUSTIC VS. WET CAUSTIC PEELING OF WHITE POTATOES

Western Potato Service, Inc., Grand Forks, N. Dak.
For primary bibliographic entry see Field 5D.
W76-06652

EVALUATION OF MILL TAILINGS DISPOSAL PRACTICES AND POTENTIAL DAM STABILITY PROBLEMS IN SOUTHWESTERN UNITED STATES. INVESTIGATION REPORT, PHELPS DODGE CORPORATION, MORENCI TAILINGS DAM, MORENCI, ARIZONA, VOLUME 2

Wahler (W.A.) and Associates, Palo Alto, Calif.
Available from the National Technical Information Service, Springfield, Va. 22161, as PB-243 075, \$7.50 in paper copy, \$2.00 in microfiche. Bureau of Mines OFR 50(2)-75, December 1974. 172 p. 25 fig., 3 tab., 16 ref., 2 append. Bu Mines S0110520.

Descriptors: *Arizona, *Embankments, *Waste disposal, *Mining, Drill holes, Geologic control, Failures, Disposal, Research facilities Seismic properties, Engineering, Piezometers, Materials testing, Sampling, Testing procedures.
Identifiers: *Tailings, *Morenci(Ariz), Disposal practices, Field density, Failure conditions.

The Phelps Dodge Corporation's tailings embankments numbers 1 West and 2 West, at Morenci, Arizona, were studied. Pertinent factors relating to the physical features and operational characteristics of the facility were described. These included information on embankment construction practices and investigation of the general geologic and seismicity characteristics of the site and vicinity. Limited field exploration and sampling of materials was made at the site. Piezometers, surface movement markers, and slope indicator casings were installed and monitored on a limited basis. In the laboratory, tests were made of materials to evaluate the basic index and engineering properties of the embankment and tailings materials. Selected engineering analyses of the embankment for various types of potential 'failure' conditions were made. The report included two very detailed appendices. (See also W76-06670 thru W76-06672) (Roberts-ISWS) W76-06669

EVALUATION OF MILL TAILINGS DISPOSAL PRACTICES AND POTENTIAL DAM STABILITY PROBLEMS IN SOUTHWESTERN UNITED STATES. INVESTIGATION REPORT, KENECOTT COPPER CORPORATION, MAGNA TAILINGS DAM, MAGNA, UTAH, VOLUME 3, Wahler (W.A.) and Associates, Palo Alto, Calif.
Available from the National Technical Information Service, Springfield, Va. 22161, as PB-243 076, \$8.00 in paper copy, \$2.25 in microfiche. Bureau of Mines OFR 50(3)-75, December 1974. 226 p. 22 fig., 3 tab., 21 ref., 3 append. Bu Mines S0110520.

Descriptors: *Embankments, *Utah, *Waste disposal, *Mining, Sites, Drilling, Disposal, Research facilities, Geologic control, Failures, Seismic properties, Engineering, Piezometers, Materials testing, Sampling, Testing procedures.
Identifiers: *Tailings, *Site geology, *Magna(Utah), Disposal system, Seismicity, Refuse disposal system, Field exploration.

The results of studies of Kennecott Copper Corporation's tailings embankment at Magna, Utah, were described. Stability studies were performed on only one cross section of the embankment by utilizing data obtained from drilling, sampling, and testing, which was limited in nature. Data were collected to provide background information to support the overall research effort. It was not possible to evaluate the degree of safety or adequacy of the embankment disposal system. The Magna tailings deposit is located within the Basin and Range structural and physiographic province of western United States. The formation is moderately to complexly folded, with fold axes trending approximately in a north to northeast direction. The tailings deposit lies on partially indurated lake sediments of the Great Salt Lake and of the former Lake Bonneville, which consist mostly of clay with sand and gravel. The nearest known active fault is about 12 mi east of the tailings area. The report contained a discussion of site geology and seismicity, information on the refuse disposal system, pertinent characteristics of the tailings materials, a summary of engineering analyses, and a set of references. (See also W76-06669) (Roberts-ISWS) W76-06670

EVALUATION OF MILL TAILINGS DISPOSAL PRACTICES AND POTENTIAL DAM STABILITY PROBLEMS IN SOUTHWESTERN UNITED STATES. RECONNAISSANCE REPORT, VOLUME 5, Wahler (W.A.) and Associates, Palo Alto, Calif.

Available from the National Technical Information Service, Springfield, Va. 22161 as PB-243 078, \$4.50 in paper copy, \$2.25 in microfiche. Bureau of Mines OFR 50(5)-75, December 1974. 55 p, 4 fig, 27 photos. Bu Mines S0110520.

Descriptors: *Waste dumps, *Mining, *Waste disposal, Copper, Iron, Lead, Zinc, Phosphates, Mining engineering, Investigations, Sampling, Drilling equipment, Soils, Drilling, Bulk density, Surveys.
Identifiers: *Mill refuse, *Mining industry, Reconnaissance-level investigations.

Reconnaissance-level investigations were carried out to gather supplemental data to the in-depth studies of Kennecott's Magna and Phelps Dodge's Morenci tailings deposits and Kennecott's Chino leaching dump. The data were obtained to determine to what extent the disposal systems and techniques used at the three sites studied in depth typify those of the mining industry, represented by the 15 other sites. The sites visited were classified according to the different systems and techniques used by the mining industry. The probable effects and relationships between site conditions and disposal methods were determined and evaluated to the extent feasible. The visits were comprehensive; the purpose was mainly to determine how these sites related to those for which detailed investigations were accomplished in order to define areas requiring further in-depth investigations. The visits consisted of discussions with mining company representatives (to obtain information regarding disposal plans, design considerations and historical data on dam construction), followed by inspection of the disposal structures. Aerial observation surveys were also conducted to supplement data obtained during the ground inspection and to obtain overall views of the sites. (See also W76-06669) (Roberts-ISWS) W76-06672

PETROLEUM-OXIDIZING BACTERIA FROM THE GULF OF FINLAND, (IN RUSSIAN), Dep. Moscow State Univ. (USSR). Dept. of Microbiology.
For primary bibliographic entry see Field 5C. W76-06788

TREATMENT PLANTS FOR REMOVING HELMINTHS FROM SEWAGE BEFORE ITS USE ON CULTIVATED PASTURES, (IN RUSSIAN), All-Union Scientific Research Inst. of Medical Parasitology and Tropical Diseases, Moscow (USSR).
For primary bibliographic entry see Field 5D. W76-06795

6. WATER RESOURCES PLANNING

EPA STANDARDS: HEALTH OR HEADACHE, North Carolina Univ., Chapel Hill. Dept. of Environmental Sciences and Engineering.
For primary bibliographic entry see Field 5G. W76-06489

6A. Techniques Of Planning

A MARGINAL COST BASIS FOR METROPOLITAN WATER SUPPLY ALLOCATION AND OPERATION, Northwestern Univ., Evanston, Ill. Dept. of Civil Engineering.
D. L. Hey.
Available from the National Technical Information Service, Springfield, Va. 22161, as PB-251 567, \$7.50 in paper copy, \$2.25 in microfiche. Ph.D. Thesis, June 1974. 185 p, 17 fig, 14 tab, 49 ref, 4 append. OWRB B-059-ILL (5), 14-31-0001-3276.

Descriptors: *Water transfer, Regional analysis, Water demand, *Water supply, Operations, *Marginal costs, *Water distribution (Applied), Optimum development plans, Cost analysis, *Municipal water.
Identifiers: Geometric programming.

In most metropolitan areas, water is supplied to the general public through treatment plants, pumping stations, reservoirs or distribution networks. Allocation of production and transportation of these separate but adjacent supply systems is determined by the demand within a municipality. The excess capacity of one system could augment another system lacking capacity and thereby improve the use of treatment, transportation, and storage facilities of both systems. The problem is to minimize the cost of providing potable water, given a multiple-plant, regional water supply system. Optimal use of the regional systems is the main issue and not the expansion of the system. The relationships between costs of transportation, production and quantity of water were combined in an objective function that describes the variable cost of regional water supply. The transportation cost function was found to vary with the period of operation. Geometric programming was used to solve the non-linear equations describing the energy needs for transporting water. Since marginal cost analysis produces the most efficient ratio of outputs to given total demand, this knowledge can lead to better use of the existing capacity which could result in the delay or avoidance of additional capitalization. (Gemmell-Illinois) W76-06164

A SIMULATION MODEL FOR THE MANAGEMENT OF LOW DENSITY RECREATIONAL AREAS, State Univ. of New York at Binghamton. Dept. of Economics.
For primary bibliographic entry see Field 6B. W76-06233

THE WATERSHED APPROACH TO UNDERSTANDING OUR ENVIRONMENT, Agricultural Research Service, Fort Collins, Colo.
For primary bibliographic entry see Field 5G. W76-06311

PUBLIC INVOLVEMENT IN THE CORPS OF ENGINEERS PLANNING PROCESS, Institute for Water Resources (Army), Fort Belvoir, Va.
For primary bibliographic entry see Field 6B. W76-06417

DETERMINATION OF OPTIMUM QUANTITY OF SERVICE WATER OBTAINABLE FROM ONE DAM SYSTEM, Kyushu Inst. of Tech., Kitakyushu (Japan).
For primary bibliographic entry see Field 4A. W76-06419

EVALUATION OF SHORT-TERM OPERATIONAL POLICIES FOR A MULTI-PURPOSE RESERVOIR SYSTEM, Water Resources Board, Reading (England).
For primary bibliographic entry see Field 4A. W76-06420

RELEASE CONTROL POLICY FOR A LARGE LAKE SUBJECT TO WIND WAVES, Water Resources Center, Budapest (Hungary).
For primary bibliographic entry see Field 4A. W76-06421

CONTROL OF A RIVER SYSTEM WITH TWO STORAGE RESERVOIRS, Birmingham Univ. (England). Dept. of Civil Engineering.
For primary bibliographic entry see Field 4A.

W76-06422

VIABILITY OF EXISTING WATER RESOURCE MODELS, THE POTOMAC RIVER BASIN WATER SUPPLY ALTERNATIVES, Interstate Commission on the Potomac River Basin, Bethesda, Md.
Y. Gordon.
Journal of Hydrology, Vol. 28, No. 2/4, p 127-136, February 1976. 2 tab.

Descriptors: *River basins, *Water supply, *Alternative planning, *Potomac River, Hydrologic aspects, Topography, Water demand, Impounded waters, Groundwater, Imported water, Evaluation, Decision making, Mathematical models, District of Columbia.
Identifiers: Waste removal, Washington (DC), Estuarine water.

Considered are the topographic and hydrologic features of the Potomac River Basin, utilization of the River for water supply and waste removal, alternatives proposed for meeting future water demands (including impoundment, groundwater, estuarine water, and importation), and evaluation of the alternatives. The Potomac River Basin is often divided into upper and lower basins for water usage considerations. The most important factor in the supply of water to the Washington metropolitan area is that the greatest portion of the water is withdrawn from the actual flow of the river. Many of the factors that constrain our decision making as to the optimal solution to the water supply problem are not technical. Ecological and environmental considerations play a very important role in the choice of alternatives in any decision involving a change in existing environmental structure. Decision makers must establish a mathematical model which can include all the constraints and variables and test them. The present problem is how to define and analyze the growing concern of citizen groups and how to incorporate future discoveries into present planning. (Bell-Cornell) W76-06424

APPLICATION OF MULTI-REGIONAL PLANNING MODELS TO THE SCHEDULING OF LARGE-SCALE WATER RESOURCE SYSTEMS DEVELOPMENT, Geological Survey, Reston, Va.
D. W. Moody.
Journal of Hydrology (Amsterdam), Vol. 28, No. 2/4, p 101-125, February 1976. 3 fig, 2 tab, 16 equ, 14 ref.

Descriptors: *Water resources development, *Planning, *Control, *Scheduling, Water demand regions, Water supply, Projects, Constraints, Groundwater, Aquifers, Costs, *Puerto Rico, Regional development, Optimization, Mathematical models, Systems analysis, *Regional analysis.
Identifiers: *Mixed-integer programming, Cost minimization.

An important part of the water resource planning process involves the selection and scheduling of structural measures to optimize development objectives. The problem of selecting configurations of water resources projects and scheduling their construction has been discussed by a number of authors. This paper describes a water resources planning model that is also formulated as a mixed-integer program. A given geographic area is divided into planning regions within which regional water demands are assumed to be located at single points. For each planning period, the model determines the water supply projects to be built and the amount of water to be produced, treated, and imported or exported to meet future water demands at minimum present cost. Model constraints include a response function which relates groundwater withdrawals to aquifer recharge induced from stream segments forming boundaries of the aquifer. The use of this model in conjunction with

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several water demand models used to evaluate the impact on nonstructural measures is also discussed in the context of water resources planning in the Commonwealth of Puerto Rico. (Bell-Cornell)
W76-06425

THE CONTROL AND OPERATION OF NUCLEAR DESALINATION SYSTEMS.
New South Wales Univ., Kensington (Australia). School of Nuclear Engineering.
For primary bibliographic entry see Field 3A.
W76-06426

RIVER BASIN DEVELOPMENT FOR SOCIO-ECONOMIC GROWTH.
National Water Authority, Budapest (Hungary). Dept. of Water Management Policy.
For primary bibliographic entry see Field 4A.
W76-06429

WATER QUALITY CONTROL SYSTEM OF ZAGYVA RIVER BASIN.
Research Inst. for Water Resources Development, Budapest (Hungary).
For primary bibliographic entry see Field 5G.
W76-06430

SYSTEMATIC APPROACHES TO ENVIRONMENTAL IMPACT ASSESSMENT: AN EVALUATION.
Ohio State Univ., Columbus. Dept. of Civil Engineering.
For primary bibliographic entry see Field 6G.
W76-06431

PLANNING AND SELECTING MULTIOBJECTIVE PROJECTS BY GOAL PROGRAMMING.
Wesleyan Coll. Macon, Ga.
W. P. Neely, R. M. North, and J. C. Fortson.
Water Resources Bulletin, Vol. 12, No. 1, p 19-25, February 1976. 8 ref.

Descriptors: *Water resources, *Projects, *Economics, *Planning, Evaluation, River basins, Cost-benefit analysis, Environment, Mathematical models, Systems analysis, Equations, Linear programming.
Identifiers: *Goal programming, *Multiple objectives, Integer programming, Environmental planning.

Economic and environmental quality objectives as proposed by the Water Resources Council are often conflicting. Goal programming, a variant of linear programming and integer programming is proposed as a technique for considering the multiple objectives in water resources project planning and selection. The method enables a comprehensive water resources model which considers both the economic and environmental objectives and may be implemented with data which are available to project planners. (Bell-Cornell)
W76-06432

TRANSIENT WATER QUALITY MODELING IN STREAMS.
Cornell Univ., Ithaca, N.Y. School of Civil and Environmental Engineering.
For primary bibliographic entry see Field 5B.
W76-06433

LONG-TERM OPERATION OF STORAGE HYDRO PROJECTS.
British Columbia Univ., Vancouver. Dept. of Civil Engineering.
For primary bibliographic entry see Field 4A.
W76-06434

FLOOD DAMAGE REDUCTION POTENTIAL OF RIVER FORECAST.
Wisconsin Univ., Green Bay. Coll. of Environmental Science.
For primary bibliographic entry see Field 6F.
W76-06435

A PRACTICAL MONTHLY OPTIMUM OPERATIONS MODEL.
Bureau of Reclamation, Sacramento, Calif. Mid-Pacific Regional Office; and Bureau of Reclamation, Sacramento, Calif. Water and Power Control Div.
For primary bibliographic entry see Field 4A.
W76-06436

DIVERSION OF WATER THROUGH NORTHFIELD MT. PUMPED STORAGE PROJECT.
Stone and Webster Engineering Corp., Boston, Mass. Water Resources Group.
For primary bibliographic entry see Field 4A.
W76-06437

WATER PLAN RANKING AND THE PUBLIC INTEREST.
Stanford Univ., Calif. Dept. of Civil Engineering.
For primary bibliographic entry see Field 6B.
W76-06438

WATER QUALITY PLANNING STRATEGY.
Camp, Dresser and McKee, Inc., Boston, Mass.
For primary bibliographic entry see Field 5G.
W76-06439

PLANNING WATER RESOURCES RESEARCH PROGRAMS.
Idaho Univ., Moscow. Water Resources Research Inst.
For primary bibliographic entry see Field 6B.
W76-06440

COGNITIVE STRAWMAN: PUBLIC INPUT TO A WATER RESOURCE PLANNING SYSTEM.
Utah State Univ., Logan. Technical Committee of the Water Resources Research Centers of the Thirteen Western States.
For primary bibliographic entry see Field 6B.
W76-06448

UNCERTAINTIES IN KARSTIC WATER RESOURCES SYSTEMS.
Arizona Univ., Tucson. Dept. of Systems and Industrial Engineering.
For primary bibliographic entry see Field 2F.
W76-06595

A COST ANALYSIS SYSTEM FOR PORTS.
Peruvian Port Organization, Callao.
A. Dover.
Dock and Harbour Authority, Vol. 56, No. 658, p. 118-123, 1975. 1 tab.

Descriptors: *Cost analysis, *South America, *Harbors, Ships, Management, Income, Tariff, Indirect costs, Direct costs, Facilities, Operating costs, Systems analysis, Equipment, Depreciation.
Identifiers: *Callao(Peru).

The accounting system used in the Port of Callao, Peru, based on costs per vessel, is described. The principal export cargoes are minerals and fishmeal; the imports are general break-bulk cargoes as well as bulk grain and petroleum products. The system used is based on the job control method used in the civil engineering industry and applied to evaluation of costs per vessel instead of costs per unit weight or volume of cargo. Cost analyses were computerized of direct operational, direct

administrative, general administrative, infrastructure, main office, and reserve and investment fund costs. System flow charts are prepared to obtain stevedoring costs per vessel, tonnages loaded and discharged per vessel per month, tonnages received and dispatched by shed and open storage area per month, unit rates, quay labor, and revenue obtained for each vessel. Unit hourly rates are derived for handling equipment by establishing optimum life for each equipment category; annual equipment depreciation plus annual repairs and maintenance were determined and spread over total hours worked annually. Handling rates on a tonnage basis were established for each shed or open storage area on the basis of total cost for each reception and dispatch area divided by tonnages handled. (Buchanan-Davidson--Wisconsin)
W76-06631

FIBONACCI SEARCH FOR HIGH-YIELD WELL SITES.
California Univ., Davis. Dept. of Civil Engineering.
For primary bibliographic entry see Field 4B.
W76-06686

6B. Evaluation Process

KANSAS GROUNDWATER POLICY SEMINAR.
Kansas Water Resources Research Inst., Manhattan.
For primary bibliographic entry see Field 4B.
W76-06154

SOCIOECONOMIC ANALYSIS OF A MAJOR REHABILITATION OF IRRIGATION AND WATER MANAGEMENT SYSTEMS IN EASTERN IDAHO.
Idaho Univ., Moscow. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 3F.
W76-06161

FORMULATION AND USE OF PRACTICAL MODELS FOR RIVER QUALITY ASSESSMENT.
Geological Survey, Portland, Oreg. Water Resources Div.
For primary bibliographic entry see Field 5G.
W76-06209

AN EVALUATION OF COST-BENEFIT ANALYSIS CRITERIA.
Leeds Univ. (Scotland). Inst. for Transport Studies.
C. Nash, D. Pearce, and J. Stanley.
Scottish Journal of Political Economy, Vol. XXII, No. 2, p. 122-134, 1975. 31 ref.

Descriptors: *Cost-benefit analysis, *Measurement, *Ethics, Social aspects, Decision making, Evaluation, Equitable apportionment.

Certain premises in the field of cost-benefit analysis are questioned in order to show that the choice between them can only be made on moral rather than logical grounds. An attempt is made to clarify the moral notions underlying existing cost-benefit procedures, which are then related to specific ethical values. Although the logic of some of the arguments used to justify particular procedures are questioned, ultimately each procedure can be related to some set of moral notions, and thus the choice between methods is in the end an ethical one, based on value judgments. It is implied that cost-benefit analysis will be most useful if results are presented in a disaggregated format, such as that of Lichfield's Planning Balance Sheet (Lichfield 1968) with incidence of effects and methods of valuation clearly stated, which can then be adjusted to conform to specific equity no-

tions, and thus reach an informed opinion of the desirability of the scheme. One of the difficulties the cost-benefit analysts face is an apparent incompatibility of their work with growing demands for public participation in planning. Often, cost-benefit analyses have been used to justify to the public decisions already taken, rather than to inform the public of the consequences of alternative courses of action. (Auen-Wisconsin)
W76-06227

THE EVALUATION OF BENEFITS FROM RECREATIONAL PROJECTS.
Hull Univ. (England). Dept. of Economics.
R. W. Vickerman.
Urban Studies, Vol. 11, No. 3, p. 277-288, 1975. 4 tab., 8 ref.

Descriptors: *Recreation demand, *Benefits, *Evaluation, Model studies, Elasticity of demand.
Identifiers: England.

Some fundamental objections are raised to Clawson's (1959) methodology for the appraisal of recreational project benefits. The Clawson Method uses trip length distribution functions and combines the demand curve, identifies the beneficiaries, and evaluates benefits. However, the central problem in this approach is that the implied recreation demand function deals with only a single facility at a time. This assumes that in order to make a prediction for a new site the situation concerning an existing site can be transferred through time and space; no reference is made to the supply prices of substitutes. The 'product' definition can best be done by reference to the elasticity of substitution. The suggested model would first identify the effects of a new facility on recreation to define the relevant area of analysis. The likely degree of substitution between activities must also be allowed for, and should involve the construction of indices to express revision in recreation habits in the form of spatial potential. It should also be considered that development of a new site or recreation facility may indirectly benefit other sites by inducing substitution of an activity and growth in total demand while transport improvements and other independent influences on mobility enable a wider variety of sites to be visited. (Auen-Wisconsin)
W76-06229

ECONOMIC BENEFITS OF POTABLE WATER SUPPLIES IN RURAL AREAS OF DEVELOPING COUNTRIES.
Kent State Univ., Ohio. Dept. of Economics.
R. J. Saunders.
Journal American Water Works Association, Vol. 67, No. 6, p. 314-317, 1975. 23 ref.

Descriptors: *Foreign countries, *Rural areas, *Water supply, *Benefits, Economic impact, Social impact, Income distribution, Financing.
Identifiers: *Underdeveloped countries.

The problems of measuring benefits of potable water supplies to rural villages in underdeveloped countries are discussed. The concept that a potable water supply for villages of a developing country is necessary for economic growth is fallible because the potable water supply alone is not sufficient to stimulate economic development, irrespective of any improved health benefits. If the water supply system is designed to provide water for livestock, irrigation of small gardens, and is complemented by health education, sanitation, feeder roads, and marketing information the probability exists that a water supply program will have an economic impact. The major administrative problems associated with providing piped water to rural villages are due to the lack of incentive and expertise for operation and maintenance of the systems. Factors that increase the potential of successful performance of the administration and financial aspects of such programs are contributions of labor and money to help cover con-

structions costs, user fees that at least cover operation and maintenance expenses, and that rural water supply programs are controlled by a national or regional agency. Investment in a water supply system in rural areas in Third World countries will generally result in income redistribution from higher-income urban to lower-income rural areas and urban slums. (Auen-Wisconsin).
W76-06230

SOME PROBLEMS IN ESTIMATING THE DEMAND FOR OUTDOOR RECREATION.
Rhode Island Univ., Kingston. Dept. of Resource Economics.
For primary bibliographic entry see Field 6D.
W76-06232

A SIMULATION MODEL FOR THE MANAGEMENT OF LOW DENSITY RECREATIONAL AREAS.
State Univ. of New York at Binghamton. Dept. of Economics.
V. K. Smith, and J. V. Krutilla.
Journal of Environmental Economics and Management, Vol. 1, No. 3, p. 187-201, 1974. 1 fig., 7 tab., 11 ref., 1 append. FS Int-19-03(10).

Descriptors: *National recreation areas, *Carrying capacity, *Public lands, *Model studies, *Density, National parks, Management, Use rates, Attitudes, Behavior, Montana.
Identifiers: *Congestion, Wilderness recreation, Wildland areas, Primitive areas, Spanish Peaks(Mont).

The economic concept of 'carrying capacity', defined in terms of the maximum level of output of a constant quality available from a given resource, is the norm for measuring the attributes of primitive recreation areas in terms of solitude enjoyed during an outing. Solitude is defined as a recreation activity with members of a group of their choosing; intrusion upon solitude refers to interaction with others outside the group. The number and types of encounters with other parties were found to be useful proxies for the disruption of solitude and, as such, erode the quality of the recreation experience (i.e., impose congestion costs). These were used as criteria for a large scale simulation model to estimate these effects for a wilderness area. The model is parameterized to correspond to the 1970 recreational season conditions in the Spanish Peaks Primitive Area in Montana. In order to take account of the congestion externalities associated with increased use intensity during a given period, the model determines the effects of alternative use levels on the expected quality of each individual's experience. The simulation experiments were designed to examine the effects of total use and pattern of use on measured encounters as a guide to management decisions. (Auen-Wisconsin).
W76-06233

A FRAMEWORK FOR EVALUATING INSTITUTIONAL AND SOCIO-ECONOMIC ISSUES OF LAND TREATMENT OF WASTE WATER.
Economic Research Service, Upper Darby, Pa.
Natural Resource Economics Div.
For primary bibliographic entry see Field 5G.
W76-06320

THE DEVELOPING ROLE OF WATER AUTHORITIES.
South West Water Authority (England). Exeter Div.
G. D. Slade.
Chartered Municipal Engineer, Vol. 102, No. 11, p. 211-215, November, 1975. 3 fig, 6 ref.

Descriptors: *Administration, *Water resources development, Comprehensive planning, Regional planning.
Identifiers: *Water authorities(G.B.)

Population increases, food production increase demands, industrial relocation, increased housing demands, more recreation, redistribution of wealth, and better communications all exert pressures on the newly-established Water Authorities in Great Britain to provide more water, main drainage, land drainage, and water-space amenities. The interplay between national, regional, and local resources is complicated. Already the regional Water Authorities must evaluate themselves and their relations with national and local contacts. Broader national policies and more co-operation between regions must be accepted. A composite management/structure type committee to assess the reorganized system and the two Royal Commission reports is recommended. In the development of the Water Authorities, important guidelines for future policies can be established. (Loustau-FIRL)
W76-06322

PUBLIC INVOLVEMENT IN THE CORPS OF ENGINEERS PLANNING PROCESS.
Institute for Water Resources (Army), Fort Belvoir, Va.
J. R. Hanchey.
IWR Research Report 75-R4, October 1975. 44 p, 49 ref, append.

Descriptors: *Water resources, *Planning, *Public participation, Management, Design, Decision making, Budgeting, Communication.
Identifiers: Public information programs.

This report discusses the design, implementation, and management of public involvement programs as integral parts of the Corps of Engineers water resources planning process. The approach to program development suggested relies on several key concepts: (1) planning should be viewed as consisting of several sequential stages, each of which has a definable output and therefore represents an implicit or explicit decision point; (2) public involvement programs can and should be approached on a stage-by-stage basis; (3) there should be public checkpoints at the end of each stage to provide the public and the reviewing elements of the Corps with citizen input as to the adequacy and responsiveness of the planning to date; (4) these public checkpoints are not in themselves adequate, but are only the culmination of active participation during each planning stage by limited segments of the public; and (5) decision making responsive to public concerns requires the explicit consideration of public input before key decisions are made at each stage. The report includes chapters on developing public involvement programs, forums for obtaining citizen input, guidelines for developing public information programs, monitoring and evaluation of programs, and staff organization and budgeting for public involvement activities. (Bell-Cornell)
W76-06417

A STUDY TO ASSESS GOALS FOR USES AND MANAGEMENT OF SHORELINE AND IMPLICATIONS FOR CORPS OF ENGINEERS PROGRAMS.
Coastal Zone Resources Corp. Wilmington, N. C.
IWR Contract Report 75-4, U. S. Army Corps of Engineers, Institute for Water Resources, Fort Belvoir, Virginia, July 1975. 101 p, 4 fig, 3 tab, 49 ref. DACW-31-75-C-0017

Descriptors: *Coasts, *Management, *Assessment, Shore protection, Legislation, Governments, Beach erosion, Control, Programs.
Identifiers: *Coastal zone management.

A high level of activity relating to use and management of shorelines and the coastal zone is in evidence. This study is an assessment of the significance of legislation, policies and actions affecting the coastal zone at all levels of government. The assessed activities are interpreted for their significance to Corps of Engineer programs in

Field 6—WATER RESOURCES PLANNING

Group 6B—Evaluation Process

shore protection. The study concludes that the state assert their authority for the coastal zone management function and the Federal agencies should help identify and perform activities complementary to state programs. Further, the Corps is advised to formulate its technical support relationships with State Coastal Zone agencies, develop and prepare educational materials to assist in coastal zone problems, expand research in coastal problems and explain remote sensing technology. (Bell-Cornell)
W76-06418

VIABILITY OF EXISTING WATER RESOURCE MODELS, THE POTOMAC RIVER BASIN WATER SUPPLY ALTERNATIVES.
Interstate Commission on the Potomac River Basin, Bethesda, Md.
For primary bibliographic entry see Field 6A.
W76-06424

COOPERATIVE MANAGEMENT AND DEVELOPMENT OF INTERNATIONAL RIVER BASINS.
Cornell Univ., Ithaca, N.Y. School of Civil and Environmental Engineering.
For primary bibliographic entry see Field 4A.
W76-06428

RIVER BASIN DEVELOPMENT FOR SOCIO-ECONOMIC GROWTH.
National Water Authority, Budapest (Hungary).
Dept. of Water Management Policy.
For primary bibliographic entry see Field 4A.
W76-06429

PLANNING AND SELECTING MULTIOBJECTIVE PROJECTS BY GOAL PROGRAMMING.
Wesleyan Coll. Macon, Ga.
For primary bibliographic entry see Field 6A.
W76-06432

WATER PLAN RANKING AND THE PUBLIC INTEREST.
Stanford Univ., Calif. Dept. of Civil Engineering.
L. Ortolano.
Journal of the Water Resources Planning and Management Division, Proceedings of the American Society of Civil Engineers, Proceedings paper No. 12068, Vol. 102, No. WR1, p 35-48, April, 1976, 2 fig, 25 ref.

Descriptors: *Water resources, *Planning, *Environmental effects, *Social participation, Economic efficiency, Equations, Water law.
Identifiers: Multiple objectives, Weighted sum of objectives technique, Weighted sum of factors technique, Federal laws.

The 'public interest,' which often serves as the basis for ranking alternative Federal water resources plans, is defined in terms of the following: What factors should be considered and how should the factors be weighed relative to one another in ranking proposals. Answers to these questions provide the framework for an analysis of several approaches that have been used in ranking alternatives (e.g., economic efficiency, weighted sum of objectives). In the course of examining these approaches, an argument is made in support of trends toward the direct involvement of citizens in the determination of factors and weights. The approaches examined, as they are commonly employed in practice, are shown to be less than satisfactory in terms of involving citizens in determining factors and weights. A process is outlined which integrates public involvement activities into the ranking of alternatives and which has been found useful in the context of Corps of Engineers' water resources studies. (Bell-Cornell)
W76-06438

PLANNING WATER RESOURCES RESEARCH PROGRAMS.
Idaho Univ., Moscow. Water Resources Research Inst.
J. S. Gladwell.
Journal of the Water Resources Planning and Management Division, Vol. 102, No. WR1, Proceedings of the American Society of Civil Engineers, Proceedings paper No. 12072, p 3-10, April 1976.

Descriptors: *Research and Development, *Technology, *Assessment, *Water resources, *Priorities, Benefits, Creativity, Management, Planning, Economics, Social aspects, Projects, Research priorities.
Identifiers: Applied research, Basic research, Information systems, Quality.

Development of a plan for a water research program is no simple task. The manager must resolve a number of problems which, although not unique, are complicated because of the nature of the scientific enterprise. Among the problems are the balance between basic and applied research, criteria for project selection, difficulties of crash programs, staffing, establishing priorities, and control of duplication of efforts. An effective program must plan not only for the actual research effort, but must include consideration for dissemination and implementation of the results. This means that practitioners must be included in the continuing planning effort. Furthermore, the interaction between practitioners and scientists will assist in insuring that the results will be in a form that will be useable. The researchers should then be used by the funding organization to be sure that the results are understood and properly implemented. (Bell-Cornell)
W76-06440

WISCONSIN PUBLIC PARTICIPATION PROCEDURES.
For primary bibliographic entry see Field 6E.
W76-06500

COGNITIVE STRAWMAN: PUBLIC INPUT TO A WATER RESOURCE PLANNING SYSTEM.
Utah State Univ., Logan. Technical Committee of the Water Resources Research Centers of the Thirteen Western States.
R. M. Judge, P. B. Kimball, and W. W. Wilson.
Available from the National Technical Information Service, Springfield, Va 22161 as PB-251 751, \$8.00 in paper copy, \$2.25 in microfiche. Research Report, (1975). 217 p, 31 fig, 20 tab, 97 ref, 3 append. Edited by R. Gum. OWRT C-4330 (9049) (2) 14-31-0001-9049

Descriptors: *Water quality, *Decision making, Information exchange, *Evaluation, Surveys, *Social values, *Planning, Arizona, New Mexico, Psychological aspects, Rio Grande River, Attitudes, *Social needs.
Identifiers: *Multiple-objective planning, *Strawman project, *Rio Grande Valley(N Mex), *Information systems.

The purpose is to develop an information system to input public values into the planning and evaluation process. A hierarchy of goals is developed and disaggregated into terms meaningful to the general public and describing the state of the world can be input to the disaggregation. The disaggregation of community goals may provide a means of linking the technical criteria of the professional and the values and goals of the general public. Conventional scaling techniques of ranking and rating are discussed and compared with a general allocation technique and other psychological scaling methods to estimate the parameters of a function for quantifying perceived satisfaction. The general allocation technique, used in a mail survey, shows promise as a means of recovering community preferences. A power function is tested against the satisfaction ratings given to samples of

water of varying clarity. The general allocation technique was used to recover the parameters of the quantifying function. It was then applied to determine the goal and sub-goal preferences of subjects in Arizona and the Rio Grande Valley of New Mexico. (See also W76-01110)
W76-06548

REORIENTATION OF URBAN WATER RESOURCES RESEARCH. FINAL REPORT.
Rutger-The State Univ., New Brunswick, N.J. Water Resources Research Inst.
W. Whipple, Jr., M. M. Hufschmidt, B. B. Berger, D. H. Howells, and L. D. James.
Available from the National Technical Information Service, Springfield, Va 22161, as PB-251 907 \$4.50 in paper copy, \$2.25 in microfiche. Proceedings of a Workshop, published by Water Resources Research Institute, Rutgers University, February 1976, 52 p. OWRT B-062-NJ(1) 14-31-0001-5134

Descriptors: *Water quality control, Management, *Institutions, *Research priorities, *Cities, *Urbanization, *Research and development, Urban runoff, Land management, Water quality, Technology, *Urban hydrology, Flood plains.
Identifiers: *Research policy, *Urban-related water resources research, *Water-land interfaces, Urban water quality, Urban flood plain management.

This is a report of a workshop held at Quail Roost, N.C. and of final conclusions by editing and steering committee, to develop an improved program of water resources research related primarily to problems in urban and urbanizing areas. The workshop participants were widely representative of different disciplines, different regions, and of agencies and professional consultants as well as the academic community. The consensus was that the Federal approach to water resources has generally neglected the problems of metropolitan areas. Hydrological, water quality and ecological data are insufficient, technology to meet many problems is lacking, and existing institutions are ill adapted to the problems now being encountered. Particular emphasis in urban-related research needs to be given to fields of water quality, flood plain management, and interfaces with land-use planning and control. Strategies and basic objectives should be re-examined as well as the problems of planning to meet environmental objectives at reasonable cost. Programs of urban-related water resources research are recommended.
W76-06553

REORIENTATION OF URBAN WATER RESOURCES RESEARCH, EXECUTIVE SUMMARY.
Rutger-The State Univ., New Brunswick, N.J. Water Resources Research Inst.
W. Whipple, Jr., M. M. Hufschmidt, B. B. Berger, L. D. James, and B. B. Howells.
Available from the National Technical Information Service, Springfield, Va., 22161, as PB-251 908, \$3.50 in paper copy, \$2.25 in microfiche. Proceedings of a Workshop, published by Water Resources Research Institute, Rutgers University, March 1976, 15 p. OWRT-B-062-NJ(1). 14-31-0001-5134

Descriptors: *Water quality control, Management, *Institutions, *Research priorities, *Cities, *Urbanization, *Research and development, Urban runoff, Land management, Water quality, Technology, *Urban hydrology, Flood plains.
Identifiers: *Research policy, *Urban-related water resources research, *Water-land interfaces, Urban water quality, Urban flood plain management.

This is an abbreviated report of the findings of a workshop sponsored by the Universities Council on Water Resources and the Urban Water Resources Research Council of the American

Society of Civil Engineers, and held at Quail Roost, N.C. in July 1975. Recommendations for urban-related research related to water quality propose development of strategy and methodology to contribute to remedying the various deficiencies, including those in the basic planning goals and approaches, better methods of measuring and evaluating pollution from urban runoff, methods of determining the environmental effects of pollution, alternative water quality enhancement approaches (other than effluent treatment), and a better institutional framework for areawide planning. There is no unified national policy for flood plain management. Goals of economic efficiency, of avoidance of social disruption, of financial aid after a disaster, and of better land use of flood plains are expressed implicitly in various Federal programs; but they need analysis and interpretation in relevant and consistent terms. Much state legislation needs modernization to keep pace with new developments.
W76-06554

INVENTORY OF FLORIDA COASTAL ZONE PLANNING PUBLICATIONS: VOLUME I, COASTAL COUNTIES AND CITIES.
Florida Dept. of Natural Resources, Tallahassee. Bureau of Coastal Zone Planning.
For primary bibliographic entry see Field 2L.
W76-06566

INVENTORY OF FLORIDA COASTAL ZONE PLANNING PUBLICATIONS: VOLUME II, MULTI-COUNTY PLANNING DISTRICTS.
Florida Dept. of Natural Resources, Tallahassee. Bureau of Coastal Zone Planning.
For primary bibliographic entry see Field 2L.
W76-06567

INVENTORY OF FLORIDA COASTAL ZONE PLANNING PUBLICATIONS: VOLUME III, STATEWIDE.
Florida Dept. of Natural Resources, Tallahassee. Bureau of Coastal Zone Planning.
For primary bibliographic entry see Field 2L.
W76-06568

DEVELOPMENT OF A PRIORITY DETERMINATION PROCEDURE.
Rivkin/Carson, Inc., Washington, D.C.; and Edwards (Arthur) Associates, Washington, D.C.
For primary bibliographic entry see Field 5G.
W76-06571

ANNUAL REPORT 1974.
Lehigh-Northampton Counties Joint Planning Commission, Lehigh Valley, Pa.
September 1975. 27 p., 10 fig., 3 tab.

Descriptors: *Regional development, *Planning, Regions, Local governments, *Environmental effects, *Water supply, *Sewage treatment, Recreation, Employment, Storm damage, *Pennsylvania. Identifiers: Lehigh County(PA), Northampton County(PA), Housing, Policy analysis, Citizen participation.

This report covers major issues and policies of important areas: regional growth, human resources and community service, housing, recreation, environmental protection and transportation. In response to citizen questions the introduction discusses why planning takes so much time and why it may seem that plans are not implemented. It is argued that plans are being implemented but over a long period and that plans must change periodically to reflect new conditions. In 1974 the Joint Planning Commission completed the draft of the Regional Storm Drainage Plan which documents existing problems, analyzes future trends and recommends solutions for problems in individual drainage basins throughout the region. Procedures for planning of private and public

water systems were examined. A study of the public water systems in the western part of the county was initiated. Major problems exist regarding future sewage treatment plan capacity. Allentown needs to expand the plant at Kline's Island and has applied for federal funding. Construction of a sewer interceptor relief line in the western part of the county is needed. Water quality in some portions of the region is too poor to provide a safe water supply or support aquatic life. Lehigh County needs to develop a long range water supply. Proliferation of private water companies may hinder development of a regional water supply plan because it may not be economically feasible to serve fragmented leftover areas with public water. Public sewers need to be extended in urbanizing areas since developers continue to pressure for building of packaged treatment plants beyond present sewer extensions. (Smith - North Carolina)
W76-06572

NORTHERN GREAT PLAINS RESOURCE PROGRAM, WATER WORK GROUP REPORT.
Northern Great Plains Resources Program, Denver, Colo.
For primary bibliographic entry see Field 3E.
W76-06616

A NOTE ON UNCERTAINTY AND THE EVALUATION OF PUBLIC INVESTMENT DECISIONS.
State Univ. of New York at Stony Brook. Dept. of Economics.
For primary bibliographic entry see Field 6C.
W76-06617

PARETO OPTIMALITY, PURE PUBLIC GOODS, IMPURE PUBLIC GOODS AND MULTIREGIONAL SPILLOVERS.
Arizona State Univ., Tempe.
T. Sandler.
Scottish Journal of Political Economy, Vol. 22, No. 1, p. 25-38, 1975. 2 fig., 26 ref.

Descriptors: *Economic efficiency, *Governmental interrelations, *Welfare(Economics), Benefits, Optimization, Governments, Mathematical models, Planning. Identifiers: *Public goods, *Pareto optimality, International cooperation, Spillovers, Multiregional, Interregional, Congestion.

Factors involved in multiregion or multicountry sharing of public goods exemplified by common market arrangements, military alliances and congestion are examined, with particular attention to the issues of an economic theory of optimal group size when impure public goods are shared between regions, and trade-offs among interregional public goods. First, the recent literature, particularly that on impure public goods and on optimal provision of public goods by local governments, is integrated in order to derive the efficiency conditions in a number of diverse situations. Pareto-optimal ratios are stated for a number of cases, including: (a) that in which any number of participating regions and multiple public goods are producing interregional spillovers of benefits, (b) the situation in which a good is impurely public both within and between regions due to congestion costs. User fees and their role in financing an optimal quantity of the public good are also discussed. Secondly, an analysis of the behavioral assumption regarding cooperation indicates that the independent adjustment equilibrium and the Pareto-optimal equilibrium serve as bounds to the cooperative equilibrium. (Luedtke-Wisconsin).
W76-06620

EXTERNALITIES AND COASE THEOREM: A GRAPHICAL ANALYSIS.
For primary bibliographic entry see Field 6C.
W76-06621

LAKE LOCATION AND QUALITY AS DETERMINANTS OF POTENTIAL RECREATION BENEFITS: A STUDY OF SELECTED LAKES IN MANITOBA.
Manitoba Univ., Winnipeg, Dept. of Agricultural Economics and Farm Management.
R. E. Capel, and C. B. Ross.
In: Proceedings Symposium on the Lakes of Western Canada, June 1973, Water Resources Center and the Dept. of Extension, Univ. of Alberta, Edmonton, p. 114-144. 1 fig., 12 tab., 28 ref., 3 append.

Descriptors: *Sites, *Recreation demand, *Use rates, *Benefits, *Forecasting, Lakes, *Canada, Regional development, Model studies, Estimating, Recreation facilities, Competing uses, Indicators, Data collections, Aesthetics, Regression analysis, Alternate planning, Decision making. Identifiers: *Manitoba, Recreation quality indices.

A method is proposed to help lake developers choose the plan which will provide maximum benefits. Recreational demand is considered regionally, rather than individually for each lake development project. A model developed to describe visitation by city residents to recreation areas, considers population, site location and quality, and competition between sites. Visitation patterns of Winnipeg and southwest Manitoba residents were studied. Recreational area quality indices based on presence of beaches, fishing, docks, and ramps were determined for 61 areas with various water resource qualities. The model indicated that number of visitor days spent in a recreation area per year by town residents per capita of that town's population was a function of distance from town to area and of the recreational area quality index. Data was obtained by mail questionnaires and park gate traffic counts. The model can project visitation to actual or hypothetical parks. Using travel cost techniques, demand curves can project benefits for benefit cost analysis of alternative plans. It provides a framework for planning and study of development proposals, and indicates future research needs. Lake quality indices, relationships between adjacent areas, and effects of number of recreational areas on total visitation are variables to be considered. (Buchanan-Davidson-Wisconsin).
W76-06622

COST-BENEFIT RULES IN GENERAL EQUILIBRIUM.
Queen's Univ., Kingston (Ontario).
R. W. Broadway.
Review of Economic Studies, Vol. 67 (3), No. 131, p. 361-374, 1975. 1 fig., 17 ref.

Descriptors: *Economic efficiency, *Model studies, *Government finance, Cost-benefit analysis, Taxes, Cost allocation, Mathematical models, Welfare(Economics), Prices, Marginal costs. Identifiers: Shadow prices.

The question of what rules the government should use to evaluate efficiency gains from public sector projects in a tax-distorted economy is considered. A simple general equilibrium model is employed to illustrate relationships among a variety of propositions which have appeared in the recent literature on applied welfare economics. Three cases are examined in some detail: (1) The Hotelling-Harberger-Lesourne proposition that in order to measure welfare changes due to government policy changes such as taxes, it is necessary to look at changes induced in the allocation of all goods and factors which are sold at distorted prices, (2) the Harberger proposition that when the government undertakes a project which directly involves the use of goods or factors purchased or sold on distorted markets, it ought to account for the distortions by using a shadow price or weighted average of the demand and supply prices for the good or factor, and (3) the Diamond-Mirrlees proposition that under certain conditions, when the government sets all taxes optimally, it should

Field 6—WATER RESOURCES PLANNING

Group 6B—Evaluation Process

use private sector producer prices as shadow prices in the public sector in order to achieve overall production efficiency in the economy. A more general cost-benefit rule which incorporates these special cases is also developed. (Luedtke-Wisconsin).
W76-06625

ECONOMIC ANALYSIS OF EFFLUENT GUIDELINES FOR THE ASBESTOS INDUSTRY.
Little (Arthur D.), Inc., Cambridge, Mass.
For primary bibliographic entry see Field 5G.
W76-06626

ECONOMIC ANALYSIS OF EFFLUENT GUIDELINES. THE NONFERROUS METALS INDUSTRY (ALUMINUM).
Little (Arthur D.), Inc., Cambridge, Mass.
For primary bibliographic entry see Field 5G.
W76-06627

WISCONSIN RECREATIONAL HARBOR FACILITIES ALONG LAKE MICHIGAN.
Wisconsin Univ., Parkside, Dept. of Earth Science.
L. C. Ruedisili.
Report August 1974. 45 p.

Descriptors: *Lake Michigan, *Recreation facilities, *Boating, Harbors, Docks, *Wisconsin, Marinas, Surveys, Maintenance costs.

Thirty-six small craft marinas and yacht clubs located along the western shore of Lake Michigan in Wisconsin were surveyed in detail. The facilities were located between the Wisconsin-Michigan border on the north and the Wisconsin-Illinois border to the south. Although the survey is not complete, it is believed to include all of the major facilities available to recreational boaters on Lake Michigan. The name, address, phone number and manager or commodore of each facility is listed. The services which are available to the recreational boater at each facility are shown, including gasoline and oil, telephone, water, electricity, ice and supplies, restroom facilities, shower facilities, dock attendant, marine repairs, haul-out facilities, U.S. Coast Guard, launching ramp, holding tank pump-out, UHF-FM marine radio and mooring accommodations. Comments describe the design and management of each facility and estimated annual maintenance costs of each facility. (Buchanan-Davidson--Wisconsin).
W76-06628

A SOCIO-ECONOMIC EVALUATION OF ALTERNATIVE WATER MANAGEMENT POLICIES ON THE RIO GRANDE IN NEW MEXICO.
New Mexico State Univ., University Park. Dept. of Agricultural Economics and Agricultural Business.
R. R. Landsford, S. Ben-David, and T. G. Gebhard, Jr.
Natural Resources Jour. Vol. 15 p. 307-325 (1975). 19 p., 1 fig., 4 tab., 14 ref. OWRT A-045-NMEX(8).

Descriptors: *Surface waters, *Rio Grande River, *New Mexico, *Groundwater, *Economic impact, Regulation, Economic prediction, Econometrics, Planning, Productivity, Industrial production, Employment, Human resources, Statistical models, Statistical methods, Linear programming, Optimization, Water resources, Water supply, Water utilization, Water law, Riparian waters, Irrigation, Farming, Water rights.

Three alternative water management policies have been proposed for the Rio Grande river. They are: (1) no water constraint; (2) surface-water constraint; and (3) both surface water and groundwater constraints. A socio-economic model was developed to project future water use patterns and economic development under the alternative as-

sumptions. This model was essentially a linear programming model designed to represent the New Mexico economy with special emphasis on the Rio Grande region. The model showed that without a water constraint, both regional production and water depletion were expected to exhibit the largest increase. When a surface water constraint was added the value of production decreased significantly. This decrease was even greater when both surface water and groundwater constraints were added. The added constraints, however, also drastically reduced water depletion. Such reduced depletion would be necessary for the region to support anticipated population increases in the twenty-first century. (Nurse-Florida)
W76-06644

6C. Cost Allocation, Cost Sharing, Pricing/Repayment

ENERGY AND POLLUTION CONCERNS IN DREDGING.
Army Engineer Div. South Atlantic, Atlanta, Ga.
For primary bibliographic entry see Field 5C.
W76-06183

THE ROLE OF POLLUTEE TAXES IN EXTERNALITY PROBLEMS.
Boston Coll., Chestnut Hill, Mass.
For primary bibliographic entry see Field 5G.
W76-06226

THE POLITICAL ECONOMY OF EFFLUENT CHARGES.
Pennsylvania State Univ., University Park. Center for the Study of Environmental Policy.
For primary bibliographic entry see Field 5G.
W76-06228

COSTS IN RELATION TO CHARGES AT UK COMMON-USER BERTHS.
Deep Water Terminal Ltd. (England).
A. B. Reid, and H. K. Dally.
Dock and Harbour Authority, Vol. 56, No. 658, p. 127-130, 1975. 1 fig., 5 tab., 2 ref.

Descriptors: *Harbors, *Costs, *Transportation, Facilities, Cost analysis, Europe, Operating costs, Fixed costs, Unit costs, Inflation(Economic), Port authorities.
Identifiers: *England, Common-user Berths, Container berths, Docks.

Current container-handling charges of deep-sea container berths at major United Kingdom and North European ports are examined. The annual operating cost is composed of fixed (quay works, dredging, and a proportion of infrastructure and common assets) and variable (handling equipment, maintenance, dock labor, and power) costs. There must be a basic minimum of equipment, maintenance, and manning in order to provide satisfactory service. Because the basic fixed costs of operating a container berth are high, the unit cost per container handling is highly sensitive to annual throughput. Inflation has greatly affected costs. Costs should not be so high they discourage potential clients or so low it would be difficult to break even. Present British charges do not even cover operation costs and there has been a marked reduction in general cargo handling revenue. British ports are undercharging each container they handle at common-user berths from 14.50-29 pounds sterling, so that an average berth which commenced operation in 1972 would lose about 800,000 pounds in 1975. European ports generally charge more. It is concluded that higher British handling charges would not alter their competitive position with European ports. Ports should reflect the real cost of operating container berths in their charges. (Buchanan-Davidson--Wisconsin).
W76-06234

PRE-INVESTMENT IN PORT FACILITIES.
Liverpool Univ. (England). Marine Transport Centre.
M. Whittington.
Dock and Harbour Authority, Vol. 56, No. 658, p. 131-134, 1975.

Descriptors: *Investment, *Economics, *Harbors, Engineering structures, Costs, Construction costs, Transportation, Ships, Economic feasibility, Facilities.
Identifiers: *Port facilities.

Relationships between port sector engineering costs and marine sector costs are considered so that investment decisions can be based on the entire transport picture. Cost components of bulk transport systems are ships time, port, inventory, and inland transport costs. With bulk liquid transport (such as oil) time in port and cost of suitable berths are not important factors, but the cost and availability of water of sufficient depth and area are primary constraints on vessel size. With dry bulk vessels, length of time in port increases with vessel size, and infrastructure cost rather than cost of the berth determines the optimum facility size. With conventional and containerized general cargo, costs per ton of cargo for berth are small compared to other port costs (labor and marine sector costs). Costs of providing water, space, and communications are most important in determining economic feasibilities of new port facilities. Suitable water depths determine bulk cargo project sizes, while handling speeds are important for general cargo systems. Water depths and back-up areas are important for containerized general cargo. Costs of providing port infrastructure (inland transport facilities and sheltered water of sufficient depth) are generally more important than costs associated with increased depth and berth load bearing strength. (Buchanan-Davidson--Wisconsin).
W76-06236

AN ECONOMIC STUDY OF THE UNOX AND CONVENTIONAL AERATION SYSTEMS.
For primary bibliographic entry see Field 5D.
W76-06288

COMPUTERIZED MONTHLY REPORTS, COST-EFFECTIVE ALTERNATIVE.
Massachusetts Univ., Amherst. Dept. of Civil Engineering.
For primary bibliographic entry see Field 7C.
W76-06300

MONOGRAPH FOR THE EFFECTIVENESS AND COST OF WATER TREATMENT PROCESSES FOR THE REMOVAL OF SPECIFIC CONTAMINANTS, VOLUME II, KWIK INDEX.
Volkert (David) and Associates, Bethesda, Md.
For primary bibliographic entry see Field 5F.
W76-06350

CASE STUDY: FOR THE ANALYSIS OF WATER MANAGEMENT INVESTMENTS ON HAND OF THE EXAMPLE OF THE KISKORE RIVER BARRAGE AND ITS IRRIGATION SYSTEMS.
For primary bibliographic entry see Field 4A.
W76-06427

A STANDARDIZED PROCEDURE FOR ESTIMATING COSTS OF SALINE WATER CONVERSION.
Office of Water Research and Technology, Washington, D. C.
For primary bibliographic entry see Field 3A.
W76-06550

Cost Allocation, Cost Sharing, Pricing/Repayment—Group 6C

COSTS ARE SOARING: IRRIGATING FROM THE UNDERGROUND,
Arizona Univ. Tucson. Dept. of Agricultural Economics.
For primary bibliographic entry see Field 3F.
W76-06586

THE ECONOMICS OF CONVERTING NATURAL GAS-POWERED IRRIGATION PUMPS TO ALTERNATE ENERGY SOURCES IN SOUTHEASTERN ARIZONA,
Arizona Univ., Tucson. Dept. of Agricultural Economics.
For primary bibliographic entry see Field 3F.
W76-06588

CORRELATION OF RADIOACTIVE WASTE TREATMENT COSTS AND THE ENVIRONMENTAL IMPACT OF WASTE EFFLUENTS IN THE NUCLEAR FUEL CYCLE FOR USE IN ESTABLISHING 'AS LOW AS PRACTICABLE' GUIDES—APPENDIX A. PREPARATION OF COST ESTIMATES FOR VOLUME 1, MILLING OF URANIUM ORES,
Oak Ridge National Lab., Tenn.
For primary bibliographic entry see Field 5D.
W76-06614

ESTIMATING INDIRECT COST OF URBAN WATER USE,
Koebig and Koebig, Inc., Los Angeles, Calif.
C. H. Lawrence.
Journal of the Environmental Engineering Division, American Society of Civil Engineers, Vol. 101, No. EE 4, p. 517-533, 1975. 3 fig., 4 tab., 21 ref.

Descriptors: *Impaired water quality, *Water users, *Indirect costs, *Municipal water, California, Hardness(Water), Dissolved solids, Corrosion, Damages, Water works, Equipment, Industrial water, Water softening, Economic impact, Estimated costs, Mineral water.
Identifiers: Southern California.

Correlated composites of earlier quality related cost effects studies are presented in graph form as a means of approximating the economic impact of water mineral quality on urban water consumers. Specifically, indirect costs of urban water use are estimated for the Los Angeles River Basin 4B. Water mineral quality is reflected by total dissolved solids (TDS), and the impact of water hardness on the deterioration of domestic plumbing, domestic water heaters, municipal water works equipment, industrial water treatment and all domestic and commercial measures taken to contend with total hardness, are quantified. Total impact cost curves are developed for a complete range of dissolved solids and hardness. Unit costs are presented on an overall municipal basis. The slope of the total impact cost curve, i.e., the penalty cost, is expressed in dollars/acre-foot per mg/l TDS. For the 1974 conditions believed to prevail within the highly urbanized coastal plain area of Basin 4B, the penalty cost was estimated to range between about \$25/acre foot (2.0 cents/cu m) per 100 mg/l TDS at the low TDS range and about \$35/acre ft (2.8 cents/cu m) per 100 mg/l TDS at the high TDS range. (Slattery-Wisconsin)
W76-06615

NORTHERN GREAT PLAINS RESOURCE PROGRAM, WATER WORK GROUP REPORT.
Northern Great Plains Resources Program, Denver, Colo.
For primary bibliographic entry see Field 3E.
W76-06616

A NOTE ON UNCERTAINTY AND THE EVALUATION OF PUBLIC INVESTMENT DECISIONS,
State Univ. of New York at Stony Brook. Dept. of Economics.

E. James.
American Economic Review, Vol. 65, No. 1, p. 200-205, 1975. 3 fig., 4 ref.

Descriptors: *Risks, *Project feasibility, Government finance, Investment, Decision making, Dispersion, Economies of scale.
Identifiers: Scale effect, Dispersion effect.

The controversy over the optimal handling of risk by the government between those who advocate that the government should base its decisions on prices prevailing in the market and those who argue that the appropriate social risk premium is lower than the private is considered. Whether government investment projects should be evaluated individually or as a group is examined in the context of this controversy. The Arrow-Lind argument for a low social risk premium arises from a scale effect, while the risk pooling argument arises from a dispersion effect. It is shown that the effect on dispersion of risk pooling may lead the government to accept a group of projects which were individually rejected, while the scale effect may lead the government to reject a group of projects which were accepted individually. Thus the risk spreading, scale effect, should dominate in the evaluation of individual projects and the risk pooling, dispersion effect, should dominate in the group evaluation. This theme is developed using diagrammatic techniques. The necessary and sufficient assumptions for the Arrow-Lind finding that if the time-state preference approach is used, the value of an investment to the individual depends only on its expected return, are also investigated. (Luedtke-Wisconsin).
W76-06617

CORRECTIVE TAXES FOR POLLUTION CONTROL: AN APPLICATION OF THE ENVIRONMENTAL PRICING AND STANDARDS SYSTEMS TO AGRICULTURE,
California Univ., Santa Cruz. Dept. of Economics.
For primary bibliographic entry see Field 5G.
W76-06618

PARETO OPTIMALITY, PURE PUBLIC GOODS, IMPURE PUBLIC GOODS AND MULTIREGIONAL SPOILERS,
Arizona State Univ., Tempe.
For primary bibliographic entry see Field 6B.
W76-06620

EXTERNALITIES AND COASE THEOREM: A GRAPHICAL ANALYSIS,
A. Gifford.
Quarterly Review of Economics and Business, Vol. 14, No. 4, p. 7-21, 1974. 11 fig., 12 ref.

Descriptors: *Resource allocation, *Industrial production, *Optimization, Damages, Compensation, Indirect costs, Marginal costs, Taxes.
Identifiers: *Externalities, *Coase theorem, Pigovian taxation, Nonconvexities, Transaction costs, Property rights.

A graphical analysis, which reaffirms the validity of the Coase theorem by demonstrating that differing assignments of property rights in externality situations do not lead to different resource allocations or to a breakdown in the optimal property of competition when transaction costs are zero, is developed. Allocation of rights distributes initial wealth, but has no effect on the final, socially optimal outcome. The graphic technique is also used to show that if a Pigovian tax is imposed to correct an externality situation where transaction costs are sufficiently low, the firms will be induced to bargain away from the socially optimal level of output which the taxation was originally designed to produce. The impact of taxing on resource allocation in the presence of low transaction costs is the opposite of that caused by the initial externality. Finally, it is demonstrated that problems arising from nonconvexities in the firms' cost or profit

functions will not cause the resource allocation efficiency part of the Coase theorem to break down. (Luedtke-Wisconsin).
W76-06621

STABILITY ANALYSIS OF AN EFFLUENT CHARGE AND THE 'POLLUTERS PAY' PRINCIPLE,
Louvain Univ. (Belgium).
For primary bibliographic entry see Field 5G.
W76-06623

AN ECONOMIC ANALYSIS OF GEORGIA'S MARINE CHARTER BOAT FISHING INDUSTRY,
Georgia Univ., Athens. Dept. of Agricultural Economics.
E. E. Brown, and F. J. Holemo.
Marine Fisheries Review, Vol. 37, No. 4, p. 11-12, 1975. 2 tab., 7 ref.

Descriptors: *Recreation, *Marine fisheries, *Return(Monetary), *Sport fishing, Boats, *Georgia, Economic impact, Indirect benefits.
Identifiers: *Charter boats, Party boats.

Based on the economic impact of the charter boat fishing industry in California, it is projected that this industry has growth potential in Georgia. A comparison of California's sport and commercial fishing industries indicates that sport fishing contributes more to California's economy than commercial fishing, i.e., \$100-\$200 million for sport fishing as opposed to \$45 million for commercial fishing. The secondary income effects of sport fishing, between \$300-\$400 million, exceed the \$200-\$300 million generated by commercial fishing. The food value of marine fish caught by sport fishermen is estimated to be nearly two-thirds of the commercial catch. The amount of money spent in marine recreational fishing is far in excess of the dollar value of the fish caught. The current average income of charter boat operators in Georgia is \$5108 annually, but the three most profitable charter boat operators expect yearly average net returns to total \$26,374. Fifteen of the 17 Georgia operators did not rely upon the charter income for their entire living. The break-even costs, based on 812 charter hours, were \$17 per hour, but this cost is reduced with increased hours of operation; the most profitable operators averaged 1241 hours annually resulting in a break-even cost of \$11 per hour. (Auen-Wisconsin).
W76-06624

ECONOMIC ANALYSIS OF EFFLUENT GUIDELINES FOR THE ASBESTOS INDUSTRY,
Little (Arthur D.), Inc., Cambridge, Mass.
For primary bibliographic entry see Field 5G.
W76-06626

ECONOMIC ANALYSIS OF EFFLUENT GUIDELINES. THE NONFERROUS METALS INDUSTRY (ALUMINUM),
Little (Arthur D.), Inc., Cambridge, Mass.
For primary bibliographic entry see Field 5G.
W76-06627

WISCONSIN RECREATIONAL HARBOR FACILITIES ALONG LAKE MICHIGAN,
Wisconsin Univ., Parkside, Dept. of Earth Science.
For primary bibliographic entry see Field 6B.
W76-06628

RATES MUST BE FAIR,
Black, Crow and Eidsness, Gainesville, Fla.
J. D. MacGregor.
Water and Wastes Engineering, Vol. 12, No. 5, p. 31-34, 1975. 1 fig., 8 tab.

Field 6—WATER RESOURCES PLANNING

Group 6C—Cost Allocation, Cost Sharing, Pricing/Repayment

Descriptors: *Water rates, *Equity, *Water costs, *Utilities, Cost allocation, Water utilization, *Florida.

Rate structures must develop sufficient revenues to provide for operation, maintenance, and capital investment and at the same time must distribute cost equitably to all customers in relation to the benefits they derive or expenses they cause. The base extra-capacity rate determination method divides total cost (operating and capital) into costs which vary with amount of water produced, number of customers served, and water consumption rate. Extra-capacity costs are subdivided into costs of providing maximum day and maximum hour requirements. Block meter systems afford a lower unit cost for increased consumption and related costs to total consumption, but not to rate of water consumption. A rate structure method used in Florida is presented. Customers are classified as residential, apartments, or commercial and a peak consumption ratio determined and used for the determining peak hour costs. Contributions of each new customer type to operating and capital expenses are adjusted for expanded plant capacity. A deposit of connection fee funds could offset bond parity requirements, earn the cost of capital, and supply the difference between the per thousand gallon capital cost requirement during bond indenture. This plan reflects equitable cost distribution but requires careful cash flow management. (Buchanan-Davidson--Wisconsin). W76-06629

METER REPLACEMENT PROGRAM PAYS FOR ITSELF.
Mankato Water and Sanitation Dept., Minn.
W. V. Lacina.
Water and Sewage Works, Vol. 121, No. 11, p. 73-76, 1974.

Descriptors: *Water works, *Instrumentation, Domestic water, *Minnesota, Automation, Replacement costs, Maintenance costs, Cost-benefit analysis.
Identifiers: Mankato(Minn), Remote registers.

Because customer billings for water consumption accounted for only 68% of water actually pumped, the City of Mankato, Minnesota, decided to replace all 6700 residential meters in its distribution system. Analysis showed that it would cost about \$70,000 more to modernize and repair existing equipment than to replace all meters with new plastic Recordall meters and Read-o-Matic outdoor registers. In 1972 mechanical drive units were replaced with plastic meters and outdoor registers installed. Benefits were multiplied because sewer user fees are based on metered consumption of water. Water revenue increases after meter modernization amounted to \$272,351 for 1972-1973. Total outlay was \$204,077, leaving a \$68,000 surplus. Since meter replacement costs were shared by the water and sanitation sections, the surplus was approximately \$170,000. Remote outdoor registers have eliminated meter reading delays. It is anticipated that in time the meters can be read by signals transmitted to a central computer over telephone lines; field trials are in progress to evaluate the feasibility of this approach. (Buchanan-Davidson--Wisconsin). W76-06630

A COST ANALYSIS SYSTEM FOR PORTS,
Peruvian Port Organization, Callao.
For primary bibliographic entry see Field 6A.
W76-06631

THE INFLUENCE OF FLOOD HAZARDS UPON RESIDENTIAL PROPERTY VALUES,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Agricultural Economics.
For primary bibliographic entry see Field 6F.
W76-06643

6D. Water Demand

A MARGINAL COST BASIS FOR METROPOLITAN WATER SUPPLY ALLOCATION AND OPERATION,
Northwestern Univ., Evanston, Ill. Dept. of Civil Engineering.
For primary bibliographic entry see Field 6A.
W76-06164

SOME PROBLEMS IN ESTIMATING THE DEMAND FOR OUTDOOR RECREATION,
Rhode Island Univ., Kingston. Dept. of Resource Economics.
K. E. McConnell.
American Journal of Agricultural Economics, Vol. 57, No. 2, p. 330-334, 1975. 9 ref.

Descriptors: *Recreation demand, *Evaluation, Econometrics, Measurement, Income, Travel time, Time, Use rates.

Outdoor recreation demand functions are used to make inferences about the consumers' surplus and the social welfare derived from particular sites. Therefore empirical research should be as consistent as is feasible with the theoretical structure from which the consumers' surplus is derived. Practical difficulties implied by the assumptions of utility maximization are shown. The econometric structure of a demand model must be specified so that the price coefficient may vary as income varies, thus permitting analysts to determine which demand functions are not consistent with utility maximization. An analysis of the demand for outdoor recreation in a utility maximization framework in order to analyze empirical issues of research in outdoor recreation economics is developed. The value of total time consumed by the recreation activity rather than just the time in transit is the appropriate time variable in the demand for outdoor recreation. The trip or visit, not user-days, is the unit of measurement consistent with the travel cost method. There is a priori reason to specify the demand function so that the price slope can change as income changes. (Buchanan-Davidson--Wisconsin). W76-06232

INSTITUTIONAL RATIONING OF CANAL WATER IN NORTHERN INDIA: CONFLICT BETWEEN TRADITIONAL PATTERNS AND MODERN NEEDS,
California Univ., Davis. Dept. of Agricultural Economics; and California Univ., Davis. Dept. of Water Science and Engineering.
R. B. Reidinger.
Economic Development and Cultural Change, Vol. 23, No. 1, p. 79-104, 1974. 2 fig., 5 tab., 25 ref.

Descriptors: *Irrigation canals, *Rationing(Water), *Water allocation(Policy), Channels, Reservoirs, Water supply, Farm units, Water users, Water utilization, Irrigation programs, Equitable apportionment, Irrigation systems.
Identifiers: *India, Bhakra canals(India).

Examination of the water rationing system used in the Hissar district of the Bhakra canals in north India showed that water rationing occurs at three levels: water available in the reservoir; rotation among channels; and at the farm with rotation of turns among farmers served by the same watercourse. Institutional or administrative decision rules and schedules rather than market forces govern canal-water rationing. Rationing at the various levels and the relative water scarcity cause uncertainty in the farmers' water supply and may explain the poor performance of major canal irrigation projects with respect to yields, profits, and use of irrigation potential. Competition between electricity and irrigation and interaction between canal and farm rotations are the primary causes of uncertain water supplies. The nonmarket nature of

the rationing system and its lack of flexibility and controllability preclude compensating adjustments. To meet the needs of modern agriculture and to increase the predictability, certainty, and control of canal-water supply, capacity factors should be more closely matched to crop water needs. More equal sharing of water between small farmers and increase in supply predictability is needed. A water users' association to determine distribution is a possible method for providing more flexibility and control in farm-water supply. (Buchanan-Davidson--Wisconsin). W76-06235

THE FUTURE OF WATER RESOURCES,
Wessex Water Authority, Bristol (England).
For primary bibliographic entry see Field 5F.
W76-06234

HIDDEN WATERS IN ARID LANDS.
For primary bibliographic entry see Field 4B.
W76-06585

LAKE LOCATION AND QUALITY AS DETERMINANTS OF POTENTIAL RECREATION BENEFITS: A STUDY OF SELECTED LAKES IN MANITOBA,
Manitoba Univ., Winnipeg. Dept. of Agricultural Economics and Farm Management.
For primary bibliographic entry see Field 6B.
W76-06622

6E. Water Law and Institutions

ECONOMIC AND LEGAL ANALYSIS OF ALTERNATIVE FLOOD CONTROL STRATEGIES: PHASE I,
Massachusetts Univ., Amherst. Dept. of Food and Resource Economics.
For primary bibliographic entry see Field 6F.
W76-06159

PROCEEDINGS OF CONFERENCE ON 'PERSPECTIVES ON FORMULATING STATE WATER POLICY',
Minnesota Univ., Minneapolis. Water Resources Research Center.
Available from the National Technical Information Service, Springfield, Va. 22161 as PB-251 578 \$4.50 in paper copy, \$2.25 in microfiche. WRRR Bulletin No. 85, December 1975. 51 p. OWRT A-999-MINN(39).

Descriptors: *Minnesota, *Water policy, Planning, Conferences, Water management(Applied), *State government, Research priorities, Legal aspects, Water law, Water rights, Legislation, Jurisdiction.

The program of the Conference consisted of presentations by representatives of the Legislative, Executive, and Judicial Branches of government in Minnesota. The emphasis was on the role of the three branches of government in forming and carrying out water policy, and/or the specific water policy needs in Minnesota. (Waelti-Minnesota) W76-06160

IMPLEMENTATION OF INTERSTATE WATER QUALITY PLAN,
Delaware River Basin Commission, Trenton, N.J.
For primary bibliographic entry see Field 5G.
W76-06201

THE POLITICAL ECONOMY OF EFFLUENT CHARGES,
Pennsylvania State Univ., University Park. Center for the Study of Environmental Policy.
For primary bibliographic entry see Field 5G.
W76-06228

ECONOMIC BENEFITS OF POTABLE WATER SUPPLIES IN RURAL AREAS OF DEVELOPING COUNTRIES.
Kent State Univ., Ohio. Dept. of Economics.
For primary bibliographic entry see Field 6B.
W76-06230

INSTITUTIONAL RATIONING OF CANAL WATER IN NORTHERN INDIA: CONFLICT BETWEEN TRADITIONAL PATTERNS AND MODERN NEEDS.
California Univ., Davis. Dept. of Agricultural Economics; and California Univ., Davis. Dept. of Water Science and Engineering.
For primary bibliographic entry see Field 6D.
W76-06235

THE DEVELOPING ROLE OF WATER AUTHORITIES.
South West Water Authority (England). Exeter Div.
For primary bibliographic entry see Field 6B.
W76-06232

WATER QUALITY MANAGEMENT FOR METROPOLITAN KANSAS CITY.
Black and Veatch, Kansas City, Mo.
For primary bibliographic entry see Field 5G.
W76-06233

DEALING WITH THE DISCHARGE MONITORING REPORT.
San Antonio Wastewater Treatment Plant, Tex.
For primary bibliographic entry see Field 5G.
W76-06235

HOW THE GREAT LAKES WERE EVALUATED.
Great Lakes Basin Commission, Ann Arbor, Mich.
For primary bibliographic entry see Field 5G.
W76-06239

CANADA WATER ACT - ANNUAL REPORT, 1973-74.
Department of the Environment, Ottawa (Ontario).
(1974), 30 p. English and French versions.

Descriptors: *Canada, *Water law, *Legislation, *Water management, *Water quality control, Federal government, Nutrients, Planning, Costs, Sewage, Sediments, Fisheries, Effluents, Phosphates, International Joint Commission, Flood control.
Identifiers: *Federal - provincial agreements(Canada), *Canada Water Act.

The objectives and activities under the Canada Water Act are described. The main provisions of the Act are outlined and some of the more important programs are briefly discussed. Details of various federal - provincial agreements and cooperative arrangements are also provided along with information on a program to regulate nutrient releases. Various data systems and management arrangements established or information are briefly noted and data collections are summarized. (Environment Canada)
W76-06369

THE NATURE AND EXTENT OF RIGHTS IN WATER IN NORTH DAKOTA.
R. E. Beck, and J. C. Hart.
North Dakota Law Review, Vol. 51, No. 2, p. 249-314 (1974). 66 p., 335 ref. OWRT A-035-NDK(2).

Descriptors: *North Dakota, *Water rights, *Water law, Prescriptive rights, Prior appropriation, Relative rights, Riparian rights, Governments, Judicial decisions, Legislation, Public

rights, Legal aspects, Competing uses, Federal-State water rights conflicts, Jurisdiction, Regulation, Riparian waters, Usufructuary right, Governmental interrelations.

This article discusses in depth the competing ownership and control interests in the water within North Dakota. The North Dakota Code states that ownership of the water within North Dakota is in the public. The authors state, however, that this provision can only be interpreted in light of the following considerations: private riparian and prescriptive rights and rights of appropriation under North Dakota statutes; ownership rights which may exist in the Federal government and Indian tribes; federal control over the use of water; Canadian claims to international streams; claims of other states to interstate bodies of water. The article also points out problems related to each of the claims analyzed. The authors state that many of these problems could be resolved through rule making by the State Engineer or the State Water Commission, and if they fail to act, by the North Dakota Legislature. The authors also offer suggestions to aid in the resolution of many conflicting problems. (Nursey-Florida)
W76-06378

A STUDY TO ASSESS GOALS FOR USES AND MANAGEMENT OF SHORELINE AND IMPLICATIONS FOR CORPS OF ENGINEERS PROGRAMS.
Coastal Zone Resources Corp. Wilmington, N. C.
For primary bibliographic entry see Field 6B.
W76-06418

CONTROL OF ABSTRACTION BY LAW.
F. C. C. Hodges.
Journal of Hydrology, Vol. 28, No. 2/4, p. 137-153, February 1976. 6 ref.

Descriptors: *Water resources development, *Conservation, *Water law, *Water rights, Water utilization, Control, Surface waters, Aquifers, Riparian rights, Rivers, Flow, Irrigation, Water pollution.
Identifiers: Water abstraction.

The conservation and development of water resources involves control by law of any abstraction of water. The law of a country relating to its water rights must play a major part where development is concerned, particularly in arid and semiarid countries. This paper considers various facets of major water use in general terms and considers ancillary problems connected with those abstractions, with some views and recommendations as to possible methods to be considered and actions to be taken to control legally these varying uses. Discussed are systems of laws relating to both abstraction from surfaced sources and underground aquifers (including Common Law, appropriation, combined Common Law - Riparian/Appropriation, full state ownership, and state ownership combined with minor private ownership), comparison between systems, definition of constituents of a water source in respect of water rights, underground sources, and interrelationship between underground aquifer-surface flow. Considered also are ownership of land married to a water source, determination of water rights, irrigation and development areas, over-extraction/anticipatory legislation, registration and licensing, water pollution, leakage to potable sources, and land fragmentation and proposed consolidation schemes. (Bell-Cornell)
W76-06423

CASE STUDY: FOR THE ANALYSIS OF WATER MANAGEMENT INVESTMENTS ON HAND OF THE EXAMPLE OF THE KISKORE RIVER BARRAGE AND ITS IRRIGATION SYSTEMS.
For primary bibliographic entry see Field 4A.
W76-06427

COOPERATIVE MANAGEMENT AND DEVELOPMENT OF INTERNATIONAL RIVER BASINS.
Cornell Univ., Ithaca, N.Y. School of Civil and Environmental Engineering.
For primary bibliographic entry see Field 4A.
W76-06428

WATER QUALITY PLANNING STRATEGY.
Camp, Dresser and McKee, Inc., Boston, Mass.
For primary bibliographic entry see Field 5G.
W76-06439

DECISIONS FOR DELAWARE: SEA GRANT LOOKS AT LEGAL ASPECTS OF OCS DEVELOPMENT.
Delaware Univ., Newark. Center for the Study of Marine Policy.
G. J. Mangone, and J. Homer.
Decisions for Delaware, Marine Advisory Services, University of Delaware Sea Grant Program (Oct. 1975). 25 p., 1 map, 4 photo, 3 dwg, 2 chart.

Descriptors: *Delaware, *Continental shelf, *Ownership of beds, *Harbors, *Oceans, Beds, Waste disposal, Federal jurisdiction, Oil, Natural gas, Natural resources, Environmental effects, Permits, Water pollution control, Public health, Penalties(Legal), Legislation.
Identifiers: *Deep water ports, *Deepwater Port Act.

Recent legislation and litigation has had a significant impact on the uses of the United States outer continental shelf (OCS) including the exploration of petroleum, the development of deep water ports, and the use of the shelf as a dumping site. Because of a Supreme Court ruling that the United States has title to the ocean seabed outside of three miles from shore, the Department of the Interior will start leasing offshore lands for oil and gas development. While these leases are considered critical in spurring domestic development, several potential problems are foreseen concerning unrealistic production goals, the elimination of competition, and environmental concerns. Problems are also foreseen concerning the construction of deepwater ports authorized by the Deepwater Port Act of 1974. Many of these problems, however, have been allayed by provisions allowing the imposition of severe penalties for oil spills and other violations of the act. Penalties may also be imposed for violation of the Marine Protection, Research and Sanctuaries Act of 1972 which sets up a permit system to regulate the dumping of specified materials in the ocean. (Hoffman-Florida)
W76-06485

WATER RESOURCES DEVELOPMENT OF INTERNATIONAL RIVERS WITH SPECIAL REFERENCE TO THE DEVELOPING WORLD.
West Indies Univ., Barbados. School of Law.
For primary bibliographic entry see Field 4A.
W76-06486

THE EFFICIENT USE OF UTAH'S IRRIGATION WATER: INCREASED TRANSFERABILITY OF WATER RIGHTS.
Utah Univ., Salt Lake City. Coll. of Law.
For primary bibliographic entry see Field 3F.
W76-06487

THE COMMON LAW OF PUBLIC NUISANCE IN STATE ENVIRONMENTAL LITIGATION.
K. S. Boger.
Environmental Affairs, Vol. 4 p.367-392 (1975). 26 p., 124 ref.

Descriptors: *Public rights, *Pollution abatement, *Penalties(Legal), *State governments, *Common law, Legal aspects, Judicial decisions, Law enforcement, Legislation, Water pollution, Air pollu-

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tion, Pollutants, Water pollution control, Water quality, Water quality control, Water law, Water pollution effects.
Identifiers: *Injunctive relief, *Nuisance(Legal aspects), Standing(Legal).

A public nuisance action brought by the State can be an effective means to control private pollution when statutory and administrative remedies are inadequate and obstacles to its use such as preemption, primary jurisdiction and legislative authorization are overcome. If a State's environmental legislation contains no provision in derogation of the common law, then it seems reasonable to suppose that common law rights of action survive. Furthermore, unless the polluting activity is explicitly authorized by legislation, a public nuisance action against the offending activity should be permitted. In contrast, despite the availability of the public nuisance action, a private action to enjoin a public nuisance before it occurs has yet to be accepted by any jurisdiction without adherence to traditionally strict standing requirements. (Nursey-Florida)
W76-06488

JAPAN AND THE UNITED NATIONS CONFERENCE ON THE LAW OF THE SEA,
Johns Hopkins Univ., Washington, D.C., School for International Studies.
L. Wells, II.
Ocean Development and International Law, Vol. 2 p. 65-91 (1974). 27 p, 76 ref.

Descriptors: *Foreign countries, *United Nations, *International law, *Law of the sea, *Natural resources, Governments, Foreign waters, Legal aspects, Water law, Treaties, Foreign trade, Fishing, International waters, Commercial fishing, Economics, Mineral industry, Mining, Ownership of beds, Oil, Water resources, Navigable waters.
Identifiers: *Japan, *United Nations Conference on the Law of the Sea, Coastal waters.

Japan's dependence on the sea will have marked effects on Japan's position at the United Nations Conference on the Law of the Sea. Due to its lack of natural resources and the importance of its foreign trade, Japan is more dependent on the seas than any other major nation. Japanese interests have been well served to date by the existing law of the sea and Japan doubtless will press for re-affirmation of freedom of the seas as a fundamental principle at the UN Conference. However, despite this dependence, Japan has maintained a flexible stance on most major issues, avoiding the extreme stands taken by many other States. This flexibility will reduce the likelihood of having to make multiple concessions in exchange for the retention of are cardinal point. The author concludes that due to Japan's favorable relations with Third World and resource-rich countries, Japan should emerge from the Conference with its vested interests mostly intact. (Nursey-Florida)
W76-06491

FLOOD PLAIN AND TSUNAMI INUNDATION AREA ORDINANCE.
For primary bibliographic entry see Field 6F.
W76-06492

POLLUTION—RIGHT OF SHIPOWNER TO CONTRIBUTION FROM UNITED STATES WHERE NEGLIGENCE OF COAST GUARD WAS A CAUSE OF CASUALTY AND ENSUING SPILL. BURGESS V. THE TAMANO, 373 F SUPP 839 (D ME 1974).
For primary bibliographic entry see Field 5G.
W76-06493

SAMPLE SUBDIVISION CONTROL ORDINANCE FOR FLOOD HAZARD AREAS.
Minnesota Dept. of Natural Resources, St. Paul.
For primary bibliographic entry see Field 6F.
W76-06494

NEBRASKA NPDES PERMIT REGULATIONS.
For primary bibliographic entry see Field 5G.
W76-06495

NEVADA WATER POLLUTION CONTROL LAWS.
For primary bibliographic entry see Field 5G.
W76-06496

OREGON WATER QUALITY CONTROL REGULATIONS.
Oregon Dept. of Environmental Quality, Salem.
For primary bibliographic entry see Field 5G.
W76-06497

WISCONSIN WATER POLLUTION CONTROL LAWS.
For primary bibliographic entry see Field 5G.
W76-06498

WISCONSIN DISCHARGE PERMITS REGULATIONS.
For primary bibliographic entry see Field 5G.
W76-06499

WISCONSIN PUBLIC PARTICIPATION PROCEDURES.
In: 1974 BNA Environmental Rep. 951:0581-85 (Wisc. Ad. Code, Ch. NR3, 1974). 5 p.

Descriptors: *Permits, *Administrative decisions, *Wisconsin, *Decision making, *Comprehensive planning, Administration, Coordination, Management, Planning, Scheduling, Timing, Legislation, Adoption of practices, State governments, Public rights.
Identifiers: Public hearings, *Public participation.

To insure that interested persons are given the opportunity to make applicable comments, the Secretary of the Wisconsin Department of Natural Resources is required to issue public notice of the receipt of a completed permit application. The content and circulation requirements of this notice are set forth. To allow interested persons to make an oral statement, procedures are also set forth concerning the holding of a public hearing. If the request for such a hearing is made by the Environmental Protection Agency, any state effected by the discharge, or by a petition signed by 5 or more persons, the holding of a public hearing will be mandatory. In all other cases, the holding of a hearing shall be at the discretion of the Department. If a public hearing is held, appropriate notice shall be given. The regulations also set forth requirements pertaining to the location of the hearings, persons entitled to participate in the hearings, the conduct and transcripts of the hearing, and requests for changes in time or place of hearing. (Hoffman-Florida)
W76-06500

WISCONSIN WATER QUALITY STANDARDS.
For primary bibliographic entry see Field 5G.
W76-06501

OREGON SYNTHETIC CLEANSING AGENT ACT.
In: 1972 BNA Environmental Rep. 886:0151 (Ore. Synthetic Cleansing Agent Act, 1971).

Descriptors: *Detergents, *Oregon, *Phosphorous, *Decomposing organic matter, *Waste treatment, Penalties(Legal), Biological treatment, Legislation, State governments, Administrative decisions, Environmental effects, Discharge(Water), Standards, Regulation, Water quality control.
Identifiers: *Synthetic cleansing agents.

The Oregon Synthetic Cleansing Agent Act provides that, unless a synthetic cleansing agent will degrade in a secondary sewage treatment plant, or can be decomposed into simple materials by biological means, it may not be sold in the state. Any cleansing agents sold in the state must meet applicable labeling requirements of the Department of Environmental Control. In addition, the label must contain the percentage of phosphorous by weight and the equivalency in grams of phosphorous per recommended use level. Violation of these provisions is a misdemeanor. (Hoffman-Florida)
W76-06502

UTAH WATER QUALITY STANDARDS.
For primary bibliographic entry see Field 5G.
W76-06503

WASHINGTON WATER POLLUTION CONTROL LAWS.
For primary bibliographic entry see Field 5G.
W76-06504

WASHINGTON ENVIRONMENTAL COORDINATION PROCEDURES ACT OF 1973,
In: 1974 BNA Environmental Rep 941: 0141-45 (Ch 185, Laws 1973). 5 p.

Descriptors: *Washington, *Administrative agencies, *Permits, *Coordination, *Adoption of practices, Projects, Legislation, Management, Administration, Comprehensive planning, Control, Planning, Scheduling, Decision making, State governments.
Identifiers: *Public hearings.

To assist persons who are required to obtain a number of permits before undertaking projects that will effect water resources, the state of Washington has created a mechanism that will coordinate the decision making of all interested administrative agencies. Under this mechanism, a person may file one master application to the department of ecology seeking the issuance of all permits necessary for the project. When the department receives this application, it will advise state agencies who might have permit requirements concerning the project. If notified agencies do not express an interest within a specified time, they will be barred thereafter from requiring permits for the applicant's project. If any agencies affirmatively respond, the department will forward to the applicant all necessary forms which must be completed. Upon the return receipt of these forms, the department shall give public notice of the proposed project and shall allow 30 days for the receipt of public comments. Whether a public hearing will be required before any final decision is made will depend on attendant circumstances. After all participating agencies have sent their final decision to the department, the department shall incorporate them into one document which will be transmitted to the applicant. (Hoffman-Florida)
W76-06505

WASHINGTON DEPARTMENT OF ECOLOGY ORGANIZATION.
In: 1973 BNA Environmental Rep. 941:0501-02 (Wash Ad Code, Ch. 173-02, 173-06). 2 p.

Descriptors: *Washington, *Administrative agencies, *Comprehensive planning, *Ecology, *Administration, Organizations, Management, Economics, Planning, Operations, Environmental effects, Water resources development, Law enforcement, Operations research, Scheduling, Monitoring, Technology, Research and development.

The purpose of these regulations is to assist interested persons in dealing with the department of ecology by describing its organization and

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methods. The department is divided into two branches: the public services branch, which consists of the office of technical services and the office of operations; and the administration and planning branch, which consists of the office of administration and the office of planning and program development. The office of technical services is responsible for coordinating local pollution control activities and for providing laboratory services and technical assistance. The office of operations is primarily responsible for the regulatory, financing and enforcement responsibilities pertaining to pollution control activities. Duties pertaining to fiscal and administrative functions, such as records control and public information services, are the responsibility of the office of administration. Finally, the office of program planning and development is responsible for making environmental impact reviews of major projects and for developing planning standards and criteria. Apart from these specialized duties, the department of ecology shall be responsible for the protection, improvement and maintenance of the state's water resources. (Hoffman-Florida) W76-06506

WASHINGTON WASTE WORKS REGULATIONS.

For primary bibliographic entry see Field 5G. W76-06507

WASHINGTON WATER POLLUTION CONTROL PLANNING REGULATIONS.

For primary bibliographic entry see Field 5G. W76-06508

WASHINGTON HEARINGS REGULATIONS.

In: 1975 BNA Environmental Rep 94:0741 (Wash. Ad Code, 173-225-010 through 173-225-030, 1975). 1 p.

Descriptors: *Washington, *Federal Water Pollution Control Act, *Waste water disposal, *Environmental effects, *Administrative agencies, Administration, Permits, Adoption of practices, Federal government, State governments, Administrative decisions, Water quality standards, Discharge(Water), Regulation. Identifiers: Certification statement, Public hearings.

Pursuant to Section 401 of the Federal Water Pollution Control Act (FWPCA), all applicants seeking a federal permit pertaining to discharges into navigable waters must obtain a certification from the state in which the discharge originates. This certification should state that the discharge complies with applicable provisions of sections 301, 302, 306 and 307 of the FWPCA. Because the issuance of permits could have profound environmental effects, public notice of the application for a certification must be mailed to all interested persons and to any other person on request. If the particular application is deemed to be of a general public interest, public notice of the application must be made in a specified manner in a county newspaper of general circulation. Any member of the public may make written comments to the department of ecology within 20 days after the last public notice of the application. If the department determines that a particular application is of sufficient public interest, it may hold a public hearing, in the manner prescribed, for the submission of oral views. (Hoffman-Florida) W76-06509

WASHINGTON NPDES PERMIT PROGRAM REGULATIONS.

For primary bibliographic entry see Field 5G. W76-06510

WASHINGTON WATER QUALITY STANDARDS.

For primary bibliographic entry see Field 5G.

W76-06511

WATER QUALITY STANDARDS--COLORADO RIVER SYSTEM (SALINITY CONTROL POLICY AND STANDARDS PROCEDURE).

Environmental Protection Agency, Washington, D. C.

For primary bibliographic entry see Field 5G. W76-06512

EFFLUENT GUIDELINES -- STEAM ELECTRIC POWER GENERATING POINT SOURCE CATEGORY.

Environmental Protection Agency, Washington, D. C.

For primary bibliographic entry see Field 5G. W76-06513

INORGANIC CHEMICALS MANUFACTURING POINT SOURCE CATEGORY.

Environmental Protection Agency, Washington, D. C.

For primary bibliographic entry see Field 5G. W76-06514

FISHERY FOR KING CRAB IN ALASKA.

National Marine Fisheries Service, Washington, D. C.

40 Fed Reg 16216-17 (1975). 2 p.

Descriptors: *Crabs, *Commercial shellfish, *Alaska, *Fisheries, *Fish conservation, Programs, Management, Conservation, Protection, Resources, Wildlife, Harvesting, Permits, Labor, Capital, Investigations, Ships, Regulation. Identifiers: *King crab.

These regulations set forth specific statistical and registration areas and requirements for registration of all king crab vessels in Alaska. In 1970 Alaska established certain area quotas for the allowable harvest of king crabs. The result was the expansion of king crab fishing into the Bering Sea, and the replacement of older wooden vessels with new steel vessels. Alaska now regulates the harvests and open seasons for United States king crab vessels fishing in the Bering Sea. There is concern that excessive numbers of vessels and gear exist in the king crab fishery, detrimentally affecting the ability of the state to manage it. The Alaska Commercial Fisheries Entry Commission has authority to limit or reduce the number of entry permits to a manageable level. It is proposed that until the Commission is able to determine the appropriate number of entry permits that should be outstanding, the king crab fishery in Alaska should be a Conditional Fishery and thus ineligible for financial assistance programs for adding vessels or gear to the fishery. (Segall-Florida) W76-06515

TIRE AND SYNTHETIC SEGMENT OF THE RUBBER PROCESSING POINT SOURCE CATEGORY.

Environmental Protection Agency, Washington, D. C.

For primary bibliographic entry see Field 5G. W76-06516

SOAP AND DETERGENT MANUFACTURING CATEGORY (PRETREATMENT STANDARDS FOR INCOMPATIBLE POLLUTANTS).

Environmental Protection Agency, Washington, D. C.

For primary bibliographic entry see Field 5G. W76-06517

EFFLUENT GUIDELINES AND STANDARDS -- FERROALLOYS MANUFACTURING POINT SOURCE CATEGORY.

Environmental Protection Agency, Washington, D. C.

For primary bibliographic entry see Field 5G. W76-06518

FERROALLOY MANUFACTURING POINT SOURCE CATEGORY.

Environmental Protection Agency, Washington, D. C.

For primary bibliographic entry see Field 5G. W76-06519

EFFLUENT LIMITATIONS AND GUIDELINES - PRINTING INK FORMULATING POINT SOURCE CATEGORY.

Environmental Protection Agency, Washington, D. C.

For primary bibliographic entry see Field 5G. W76-06520

NONFERROUS METALS MANUFACTURING POINT SOURCE CATEGORY.

Environmental Protection Agency, Washington, D. C.

For primary bibliographic entry see Field 5G. W76-06521

INTERIM PRIMARY DRINKING WATER STANDARDS.

Environmental Protection Agency, Washington, D. C.

For primary bibliographic entry see Field 5G. W76-06522

NAT. RES. DEF. COUNCIL V. TRAIN. (FEDERAL WATER POLLUTION ACT AMENDMENTS).

396 F Supp 1393-1402 (D.D.C. 1975). 10 p.

Descriptors: *United States, *Judicial decisions, *Federal Water Pollution Control Act, *Permits, *Effluents, Legal aspects, Water law, Judicial decisions, Federal government, Organizations, Regulation, Wastes, Water pollution sources, Water pollution control, Water pollution abatement, Water quality, Water quality control, Industrial wastes. Identifiers: *FWPCA Amendments of 1972, Effluent limitations.

Plaintiff environmental group brought an action against defendant Administrator of the Environmental Protection Agency (EPA) for declaratory judgement concerning the power of defendant to exempt certain point sources from the permit requirements under the Federal Water Pollution Control Act. Plaintiff contended that under the regulations embodied in the Act, all point sources must obtain permits before they can discharge pollutants into navigable waters. The Act did not give the Administrator of the EPA the discretion to exempt any point sources from the permit requirements. Defendant contended that the exempted point sources were ill-suited for inclusion in a permit program and the program would operate most efficiently by defendant exercising his discretion in exempting these sources. The District Court for the District of Columbia held that under the Federal Water Pollution Control Act, all point sources were intended to be covered by the permit program. Defendant did not have discretion under the Act to exempt certain point sources from the program. (Nurse-Florida) W76-06523

IDAHO FISH AND GAME ASS'N V. PICABO LIVESTOCK, INC. (PUBLIC'S RIGHT TO USE A NAVIGABLE STREAM).

528 P2d 1295-98 (Idaho 1974). 4 p.

Descriptors: *Public rights, *Idaho, *Judicial decisions, *Navigable waters, *Recreation, Legal aspects, Water law, State governments, Running waters, Navigation, Water sports, Riparian rights, Water utilization, Public access.

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Identifiers: *Water rights(Non-riparian).

Plaintiff fish and game association brought a declaratory judgement action against defendant corporation to determine the rights of the public to the use of a creek which flowed through defendant's property. Plaintiff contended that the creek was navigable because it would float logs, and therefore, the public had the right to use the creek for recreational purposes. The Supreme Court of Idaho held that the creek was navigable in that logs over six inches in diameter could be floated on it to a place of use. The court further held that the public had the right to use the creek for all recreational purposes. (Nursey-Florida)
W76-06524

STOCK V. STATE (CONSTITUTIONALITY OF STATE ENVIRONMENTAL CONSERVATION ACT).

526 P2d 3-18 (Alas. 1974). 16 p.

Descriptors: *Alaska, *Judicial decisions, *Constitutional law, *Penalties(Legal), *Water pollution control, Legal aspects, Water law, State governments, Legislation, Water pollution, Pollutants, Water pollution sources, Water pollution abatement, Water quality, Water quality control, Sewage, Wastes.

Identifiers: Due process, *Alaska State Environmental Conservation Act.

Defendant corporation president was convicted of willfully polluting state waters in violation of the Alaska State Environmental Conservation Act. Defendant appealed on grounds that the statutory definition of the prohibited 'pollution' was unconstitutionally vague in that men of ordinary intelligence could not know which activities were proscribed. Defendant further contended that the fines of \$25,000 for negligent violations and \$1000 per day for willful violations constituted cruel and unusual punishment. The Supreme Court of Alaska held that although the statute may have failed to give adequate notice as to all types of conduct which were punishable, defendant's actions of dumping raw sewage into a stream running through residential areas were clearly within the outer boundaries of prohibited conduct. Therefore, the statute was not unconstitutionally vague as applied to defendant. The court further held that the fines prescribed by the statute were not so disproportionate to the offense as to be considered cruel and unusual punishment. (Nursey-Florida)
W76-06525

CAMPBELL ESTATES, INC. V. BATES (PUNITIVE DAMAGES FOR DITCH DUMPING ALL DRAINAGE ON ADJOINING PROPERTY).

517 P2d 515-23 (Ariz Ct App 1973). 9 p.

Descriptors: *Arizona, *Judicial decisions, *Drainage effects, *Adjacent land owners, *Penalties(Legal), Legal aspects, Water law, State governments, Drainage, Drainage systems, Surface drainage, Drainage water, Ditches, Surface waters, Water control, Natural flow, Alteration of flow, Relative rights.

Identifiers: Intentional torts, Punitive damages.

Plaintiff landowners brought an action against defendant adjacent landowners for damage caused by defendants' dumping drainage directly onto plaintiffs' property. Plaintiffs sought both actual and punitive damages, contending that defendants had, by use of bulldozers, created a flood channel which emptied all the floodwaters from defendants' property onto a portion of plaintiffs' property. The natural watercourse which existed before the construction of the ditch had run across defendants' property a considerable distance from the ditch. The Arizona Court of Appeals affirmed the trial courts' conclusion that the defendants had changed the natural flow of the surface water in such a manner that surface waters were collected in an artificial channel and discharged onto plain-

tiffs' land. The Court further held that punitive damages were justified by defendants' action in building the ditch without consulting adjacent landowners. (Nursey-Florida)
W76-06526

MYERS V. HARRIS (MUST BE CLEAR AND CONVINCING EVIDENCE THAT MEANDER LINE MEANT TO BE BOUNDARY).

519 P2d 1307-09 (Wash Ct App 1974).

Descriptors: *Washington, *Judicial decisions, *Accretion(Legal aspects), *Boundaries(Property), *Ownership of beds, Legal aspects, Water law, State governments, Pacific Ocean, Meanders, High water mark, Boundary disputes, Adjacent landowners, Shores, Water rights, Tidal waters, Bodies of water, Oceans.

Identifiers: Coastal waters, Presumptions(Legal).

Plaintiff landowners brought an action to quiet title to land formed by accretion along the Pacific Ocean. The deed which conveyed the land described one of the boundaries as the meander line of the Pacific Ocean. Defendant contended that the meander line formed the boundary of the property and, therefore, plaintiffs were not owners of any land formed by accretion subsequent to the conveyance. The Washington Court of Appeals held that under state law, a deed which uses a meander line to describe the boundaries of oceanfront property conveys the property to the water unless there is clear and convincing evidence that the grantor intended the meander line to be the actual boundary. No such evidence was found here. Thus plaintiffs had title to the accreted land between the meander line and the line of mean high tide. (Nursey-Florida)
W76-06527

TAYLOR DITCH CO. V CAREY (DAMAGE TO NEARBY PROPERTY FROM IRRIGATION DITCH SEEPAGE).

520 P2d 218-30 (Wyo. 1974).

Descriptors: *Canal seepage, *Damages, *Adjacent land owners, *Wyoming, *Judicial decisions, Legal aspects, Water law, Drainage systems, State governments, Construction, Penalties(Legal), Seepage, Canals, Conveyance structures, Leakage, Canal construction, Water conveyance, Canal design, Canal linings.

Identifiers: *Negligence, Injunctive relief, Liability(Legal).

Plaintiff landowners brought an action against defendant ditch company for damage allegedly caused to plaintiffs' property by seepage from a canal built and maintained by defendant. Plaintiffs contended that defendant was negligent in failing to maintain the canal in such a manner that water would not seep from the canal onto plaintiffs' property. The Wyoming Supreme Court held that defendant had a duty to exercise due care in maintaining the canal and was negligent in its failure to prevent water from seeping onto plaintiffs' property. However, since there was insufficient proof that the damage to plaintiffs' property had been caused by the seepage, the court did not award money damages, but gave injunctive relief only. (Nursey-Florida)
W76-06528

STATE EX REL STATE GAM COMM'N V GOLD HILL IRR. DIST. (NO LIABILITY FOR RELEASING AQUATIC SOLVENT INTO CANALS WHICH OVERFLOWED CAUSING FISHKILL).

523 P2d 1287-91 (Ore Ct App 1974).

Descriptors: *Oregon, *Judicial decisions, *Water pollution effects, *Fishkill, *Penalties(Legal), Legal aspects, Legislation, Law enforcement, State governments, Water law, Fish, Fish conser-

vation, Sport fish, Water pollution, Water pollution sources, Water pollution control, Pollutants, Wastes, Wildlife conservation, Path of pollutant, Bodies of water, Overflow.

Plaintiff State Game Commission brought an action against defendant irrigation district pursuant to an Oregon statute which provides for recovery of damages for the knowingly unlawful killing of game birds, animals and fish. Plaintiff alleged that defendant had intentionally released a quantity of a petroleum related product into one of its water canals and that upon the overflow of the canal, the product passed into a river killing thousands of game fish. Defendant contended that at the time it placed the solvent into the canal it was not aware that the canal would overflow causing the fishkill. The Oregon Court of Appeals held that under the statute liability attaches only if defendant commits the act knowing it will result in the unlawful killing of game animals. Since there was insufficient evidence to show that defendant knew that placing the solvent into the canal would result in the fishkill, defendant could not be held liable under the statute. (Nursey-Florida)
W76-06529

RAMADA INNS, INC. V. SALT RIVER VALLEY WATER USERS' ASS'N (NO STRICT LIABILITY FOR CANAL'S FLOODING OF HOTEL).

523 P2d 496-99 (Ariz. 1974). 4 p.

Descriptors: *Artificial watercourses, *Canals, *Arizona, *Judicial decisions, *Floodwater, Legal aspects, Water law, Penalties(Legal), State governments, Benefits, Watercourses(Legal aspects), Surface waters, Diversion structures, Levees, Running waters, Flood damage.

Identifiers: Strict liability, Public policy.

Plaintiff hotel brought an action against defendant water users' association for damage caused to the hotel by floodwaters diverted by defendant's canal. Plaintiff's complaint alleged liability based on numerous theories including a theory of strict liability. Plaintiff contended that the canal had become a dangerous instrumentality and that its owners should be subject to strict liability for reasons of public policy. Defendant argued that the canal had been in existence for so long that it should be considered to be similar to a natural watercourse. The Supreme Court of Arizona held that due to the utility and necessity of the canal, strict liability should not be imposed upon its maintenance and existence. Those landowners who chose to locate near the canal assumed the burden of loss in situations not involving the element of fault. (Nursey-Florida)
W76-06530

WERNBERG V STATE (PAYMENT OF JUST COMPENSATION FOR TAKING OF LITTORAL PROPERTY RIGHTS).

516 P2d 1191-1201 (Alaska 1973). 11 p.

Descriptors: *Littoral, *Alaska, *Judicial decisions, *Eminent domain, *Riparian rights, Legal aspects, Constitutional law, State governments, Water law, Economics, Navigable waters, Navigation, Obstruction to flow, Riparian waters, Fishing, Commercial fishing, Construction, Tidal waters, Water levels.

Identifiers: *Police power.

Plaintiff landowner brought an action in inverse condemnation against the state of Alaska and the city of Anchorage. Plaintiff alleged that defendants took a property right without just compensation, and that a highway constructed by defendants obstructed the flow of high tide waters up a creek, thereby destroying its navigability. Plaintiff had used this creek for twenty years to navigate his fishing boats to deep water for commercial fishing. Defendants contended that under the police power of the State to regulate navigable waters, the State could obstruct the flow of tide

waters without compensating plaintiff for his loss. The Supreme Court of Alaska held that under Alaska law the State may take riparian or littoral property rights for public use, but when this taking is for a use other than to aid navigation, just compensation must be paid for the taking. The court held that the plaintiff had a littoral right to the use of the creek to gain access to deep waters; consequently, the State's destruction of the navigability of the creek constituted a taking of a property right which required just compensation by the State. (Nurse-Florida)
W76-06531

PIERCE V RILEY (ACCESS TO LAKE BY NON-RIPIARIAN OWNERS IMPERMISSIBLE EVEN THOUGH OVER THE LAND OF A RIPIARIAN OWNER).
215 NW2d 759-62 (Mich. Ct. App. 1974). 4 p.

Descriptors: *Michigan, *Riparian land, *Riparian rights, *Reasonable use, *Easements, Legal aspects, Land use, Lakes, Water law, Real property, Channels, Access routes, Judicial decisions, Relative rights, Canals.
Identifiers: *Commercial exploitation.

Defendant riparian owners developed a tract of property which did not front on the lake. To make the development more commercially attractive, the defendants dug a canal through their riparian lot so as to provide access to the lake for a large number of non-riparian lot owners. Subsequently, the other riparian owners brought an action alleging that defendants use of their riparian property put an undue burden on the lake. After the trial court had found for defendants, plaintiffs appealed to the Court of Appeals which reversed, finding that the developers had made unreasonable use of their riparian land for the sole purpose of commercial exploitation. The case was therefore remanded to the trial court to grant plaintiffs appropriate relief. Subsequently, the trial court enjoined defendants from granting easements to the lake to any of the non-riparian lot owners, but refused to order them to fill the channel since plaintiffs had requested no such relief in their complaint. Plaintiffs once again appealed, contending that if the channel was not filled, there would be no way to enforce the court order, short of constant police vigilance. The Court of Appeals agreed and ordered that the channel be filled. (Hoffman-Florida)
W76-06532

LAURICELLA V. PLANNING AND ZONING BOARD OF APPEALS (STATE PREEMPTION OF AUTHORITY OVER ALL TIDAL WETLANDS).
342 A2d 374-80 (Conn. Ct Com Pleas 1974). 7 p.

Descriptors: *Judicial decisions, *Building codes, *Zoning, *Connecticut, *Wetlands, Governmental interrelations, State governments, Local governments, Water, Water law, Legal aspects, Permits, Regulation, Administrative agencies, Tidal marshes, Construction, Buildings, Coasts.
Identifiers: State policy.

Plaintiffs, vendors and purchasers of real property, were denied a building inspector's permit to construct dwellings on grounds that a special exception was required due to the location of the premises in a wetlands area. Plaintiffs appealed that decision as well, and requested a special exception from defendant planning and zoning board of appeals. The zoning board ruled against plaintiffs, basing its decision on town building zone regulations. On appeal, the Court of Common Pleas of Connecticut concluded that, by legislative mandate, tidal wetlands such as the property in question were to be regulated solely by the state. However, certain sections of the town's zoning regulations were found to be inconsistent with state tidal wetlands law. Following the rule that ordinances, subject to certain exceptions inapplica-

ble in this case, must not conflict with state statutes, the court declared the conflicting regulations void and of no legal effect. Since plaintiffs' proposed dwellings were otherwise in conformance with the town's zoning regulations, the court ordered defendant to sustain plaintiffs' appeal from the building inspector's denial of construction permits. (Schilling-Florida)
W76-06533

DOLPHIN LANE ASS., LTD. V. SOUTHAMPTON (LOCATION OF SHORELINE PROPERTY BOUNDARY BY CUSTOMARY METHOD OF VERBAL FORMULATION).
372 NYS2d 52-55 (Ct. App. 1975). 4 p.

Descriptors: *New York, *Boundaries(Property), *High water mark, *Seashores, *Boundary disputes, Local governments, Water, Water law, Legal aspects, Judicial decisions, Bays, Beaches, Bodies of water, Shores, Coasts, Governments.
Identifiers: Coastal lands, State policy.

Plaintiff landowner brought suit against defendant town to establish the boundary line of plaintiff's shoreline property. It was undisputed that the correct boundary line of the property was the high-water line. The parties' dispute centered on the proper method by which the high-water mark should be precisely located on the land. Although evidence strongly indicated that it had previously been normal practice to locate the high-water line by reference to the line of vegetation, the trial court adopted the 'type-of-grass' test introduced by defendant. On appeal, the Court of Appeals of New York held that the application of that test was in error as a matter of law. In its decision the court concluded that no legal significance attached to any hydrographic identification of the exact line of average high water. Stressing the importance of predictability and stability in matters concerning title to real property, the court noted that the established 'line of vegetation' test could not be disregarded without altering the substance of prior conveyances. Thus the case was remanded for the purpose of determining the boundary line by reference to the line of vegetation. (Schilling-Florida)
W76-06534

CHILD V SPANISH FORK (TRANSFER OF IRRIGATION WATER AS PRECEDENT TO ANNEXATION).
538 P2d 184-88 (Utah 1975). 5 p.

Descriptors: *Water transfer, *Utah, *Water rights, *Constitutional law, *Equitable apportionment, Water contracts, Legal aspects, Water law, Water supply, Judicial decisions, Legal review, Economics, Cost allocation, Contracts, Municipal water.
Identifiers: Annexation, Statutory construction.

Defendant city had entered into an agreement whereby it agreed to annex a neighboring area into the city. As part of this agreement, plaintiff landowners were required to transfer ownership of shares of local water. Because this condition was not a part of the original proposal, plaintiffs sought a declaratory judgment that the condition was invalid. Plaintiffs contended that the applicable statute allowed the city to obtain water only by means of purchase, lease or condemnation. They also contended that the city's action was arbitrary and, since present city residents did not have to transfer water rights, denied plaintiffs equal protection. Finally, they contended that the city should have made the entire city pay for the acquisition of more water. After the trial court found for the city, plaintiffs appealed to the Utah Supreme Court. The Court affirmed the decision, however, finding that the statute in question was one of authorization and not one of limitation or restriction. As to the equal protection argument, the Court found that no discrimination existed since all members of the class were treated the

same. Finally, the Court found that the city was under no obligation to make all city residents pay for new water. (Hoffman-Florida)
W76-06535

LOS ANGELES V. SAN FERNANDO (PUEBLO RIGHTS TO WATER).
537 P2d 1250-1328 (Cal. 1975). 79 p, 7 append.

Descriptors: *Priorities, *California, *Preferences(Water rights), *Pueblo water rights, *Competing uses, Legal aspects, Judicial decisions, Legal review, Common law, Groundwater, Prescriptive rights, Water law, Imported water, Water demand, Water distribution, Water resources, Water supply, Water distribution, Appropriation.

Plaintiff city brought suit against defendant cities seeking to obtain a declaratory judgment as to its prior rights to water underlying the upper Los Angeles River area (ULARA). Plaintiff was also seeking to enjoin defendants from extracting water from this area unless such extraction was in subordination to plaintiff's prior rights. Following an adverse decision, plaintiff appealed to the California Supreme Court. After an extensive review of the history of pueblo water rights, the Court determined that plaintiff had such rights to all waters of the Los Angeles River needed for the reasonable use of its inhabitants. The Court went on to find that these pueblo rights extended to the ground waters of other areas besides the ULARA. However, the pueblo rights of the plaintiff did not include groundwater in basins that were independent from the Los Angeles River bed. Relying basically on this pueblo right determination, the Court also reversed the trial court on several other issues including: the right of plaintiff to sell groundwater derived from water from outside the ULARA; the prescriptive claims of the two parties; and the rights of the parties concerning imported water. Before reversing and remanding, the court went into an extensive review and analysis of existing law on all of these issues. (Hoffman-Florida)
W76-06536

BOROUGH OF MORRISVILLE V. DELAWARE RIVER BASIN COMMISSION (1958 FEDERAL WATER SUPPLY ACT, SURFACE WATER USE).
399 F Supp 469-79 (E D Pa 1975). 11 p.

Descriptors: *Equitable apportionment, *River basin commissions, *Pennsylvania, Reservoir construction, *Delaware River, Water storage, Dependable supply, Legal aspects, Judicial decisions, Water rates, Water law, Water rights, Water distribution(Applied), Constitutional law, Water users, Water utilization, Economics.
Identifiers: Pooled water doctrine, *National Environmental Policy Act, *Environmental impact statements.

In order to raise capital to construct two reservoirs, defendant River Basin Commission imposed charges for the use of the surface waters of the Delaware River. Defendants justified this rate imposition on the 'pooled water' concept, which holds that the enlargement of a river basin water supply benefits all users, regardless of whether that benefit is direct or indirect. Plaintiff municipalities rejected this premise, however, contending the Commission was required to relate any costs charged to a user for a project to the specific benefits derived by that user. Plaintiffs also based their request for injunctive relief on the contention that the Commission's actions exceeded its authority under the Delaware River Basin Compact, and violated certain federal statutes. Furthermore, the National Environmental Policy Act required the issuance of an environmental impact statement (EIS) before the adoption of the rate structure. The trial court rejected these contentions, however, and granted summary

Field 6—WATER RESOURCES PLANNING

Group 6E—Water Law and Institutions

judgment for plaintiffs after making the following findings of fact: the adoption of a rate structure did not put the Commission in the business of distributing water in violation of the compact; the water use charges did not constitute an unlawful taking since the constraints of equitable apportionment were not violated; and an EIS is required only upon a showing that an action will adversely affect the environment. (Hoffman-Florida) W76-06537

TAYLOR V CARRICO (NO LIABILITY FOR SPILLOVER OF ARTIFICIALLY ACCUMULATED WATER WHICH IS NOT A NUISANCE). 528 SW2d 694-96 (Ky. Ct. App. 1975).

Descriptors: *Kentucky, *Overflow, *Dams, *Farm ponds, *Lakes, Spillways, Water levels, Rain water, Rainfall-runoff relationships, Runoff, Surface runoff, Storm water, Judicial decisions, Legal aspects, Legal review, Watercourses (Legal aspects), Water control, Water injury, Water storage.

Plaintiff farm owners brought an action for injunctive relief and to recover damage resulting from the overflow of water from defendants' dam-created lake. Plaintiffs contended that as a result of heavy rains, water from the artificial lake on defendants' farm had flowed through the spillway and then across a road and onto plaintiffs' farm. The court agreed that a landowner who through artificial means causes water to accumulate on his land in such way as to constitute a nuisance is liable for any damage resulting from the escape of the accumulated water. The Kentucky Court of Appeals found no nuisance was created. Furthermore, defendants' use of their land was reasonable in that benefits derived from such use outweighed any harm to plaintiffs. Finally, the court held that the evidence introduced did not support a finding of any damages from the overflow. (Welch-Florida) W76-06538

ARNETT V COMMONWEALTH DEPARTMENT OF HIGHWAYS (LIABILITY FOR DAMAGES TO CROPS CAUSED BY DIVERSION OF WATER RESULTING FROM BRIDGE CONSTRUCTION). 528 SW2d 678-79 (Ky. Ct. App. 1975). 2 p.

Descriptors: *Bridge construction, *Damages, *Kentucky, *Streams, *Diversion, Diversion losses, Structures, Engineering structures, Judicial decisions, Alteration of flow, Riparian rights, Bridge design, Bridges, Constitutional law, Civil engineering, State governments, Administrative agencies, Legal aspects, Legal review.

Plaintiff landowners sought damages from defendant Department of Highways, alleging that the state of Kentucky had constructed a bridge across a stream on plaintiffs' property which resulted in a diversion of water. This diversion, plaintiffs claimed had ruined their crops and thus constituted a taking of property without just compensation. Defendant contended plaintiffs' action was barred by the statute of limitations and that purchase of the realty by plaintiffs after construction of the bridge deprived plaintiffs of standing to sue for the allegedly destructive diversion of water. The Kentucky Court of Appeals held the controlling question to be when the damage occurred, not when the bridge was built. Thus the complaint was not barred by the statute of limitations. On the standing question, the court held that, not withstanding plaintiffs' purchase of the property, if the state was creating a nuisance, plaintiffs could sue for compensation. The trial courts decision was reversed and remanded. (Welch-Florida) W76-06539

SIERRA CLUB V. MORTON (PROHIBITION OF DAMS AND DIKES ACROSS NAVIGABLE WATERS UNDER RIVER AND HARBORS ACT OF 1899). 400 F. Supp. 610-52 (ND Cal. 1975). 43 p. 1 map.

Descriptors: *Navigable waters, *California, *Inter-basin transfers, *Water transfer, *Rivers and Harbors Act, Water supply development, Water resources, Water management (Applied), Water rights, Judicial decisions, Permits, Legislation, Dams, Environmental effects. Identifiers: *Environmental impact statement, *California Water Project.

To redistribute California's water supply from water-rich areas to water-deficient areas, several water transfer facilities were constructed pursuant to the California Water Project. Protesting the construction and operation of these facilities plaintiff conservation groups brought an action contending that a permit was required under the Rivers and Harbors Act of 1899 before such operation could continue. The plaintiffs also contended that any such permit issuance would constitute a major federal action requiring the preparation of an environmental impact statement (EIS). At trial, the court agreed that the operation of two water project plants interfered with the navigable capacity of various waters in violation of the Rivers and Harbors Act, but rejected the plaintiffs' claim that certain structures of the project plants constituted dams or dikes over or in navigable waters. As to the EIS claim, the court found that the issuance of the permit would constitute a major federal action; however, the Army Corps of Engineers was not required to prepare an EIS if another agency was already in the process of issuing one concerning the same action. (Hoffman-Florida) W76-06540

UNITED STATES V KENNECOTT COPPER CORP (VIOLATION OF STATUTORY REQUIREMENT TO IMMEDIATELY REPORT OIL DISCHARGE INTO NAVIGABLE WATERS). 523 F2d 821-24 (9th Cir 1975). 4 p.

Descriptors: *Oil pollution, *Administrative agencies, *Federal Water Pollution Control Act, *Oil spills, Water pollution, Legal aspects, Water law, Legislation, Federal government, Judicial decisions, Law enforcement, Water pollution sources, Water pollution control, Oil pollution, Pollutants, Water quality, Water quality control, Water quality act. Identifiers: FWPCA Amendments of 1972, Administrative regulations.

Defendant corporation was convicted of a violation of a provision of the Federal Water Pollution Control Act Amendments of 1972 requiring that any person in charge of an onshore oil facility immediately notify an appropriate governmental agency of a known oil spill. Defendant appealed the conviction contending that the provision was void for vagueness because the statute failed to define adequately the terms 'immediately notify' and 'appropriate governmental agency'. The Court of Appeals held that the provision was valid since the statutory scheme clearly defined the term 'appropriate governmental agency' as encompassing any federal agency concerned with water and environmental pollution or navigable waters. The term 'immediately notify' was deemed to require notification be given reasonably promptly. The judgement was affirmed. (Nurse-Florida) W76-06541

SOUTHERN NAT. GAS CO. V GULF OIL CORP. (LIABILITY FOR DAMAGES TO UNDERWATER PIPELINE BY DREDGE WHICH WAS A 'VESSEL IN NAVIGATION'). 320 So2d 917-26 (3d La. Ct. App. 1975). 10 p.

Descriptors: *Damages, *Navigable waters, *Louisiana, *Dredging, *Channel improvement, Stream improvement, Channels, Water law, Legal aspects, Navigation, Ownership of beds, Streambeds, Riparian rights, Canals, Negligence, Accidents, Hazards, Risks, Judicial decisions, Penalties (Legal), Watercourses (Legal aspects), Pipelines, Underwater. Identifiers: Comparative negligence, Admiralty law.

Plaintiff owner of a natural gas pipeline brought this suit for damages sustained when defendant corporation's dredge ruptured plaintiff's pipeline. Defendants did not contest the trial court's holding of negligence but contended that the canal in which the dredging took place was navigable and, therefore, that the substantive law of admiralty required the application of the doctrine of comparative negligence. The Louisiana Court of Appeals agreed with defendant, finding the canal to be a navigable waterway even though it was privately owned, and that even if the pipeline was beneath the surface of the water, such damage was caused by a vessel in navigation on navigable waters. Thus the application of substantive admiralty law was required. Furthermore, plaintiff's failure to remove the pipeline or to place adequate warning signs along it even after a prior dredging accident rendered the plaintiff equally at fault in the canal dredging accident. Consequently the court required plaintiff to bear half the loss. (Welch-Florida) W76-06542

WESTERRELT V. NATURAL RESOURCES COMMISSION (RULES TO REGULATE WATERCRAFT AND LIVERIES ON THE AUSA-BLE, MANISTEE, PINE AND PERE MARQUETTE RIVERS VOID AS OVERBROAD). 233 NW2d 640-43 (Mich. Ct. App. 1975). 4 p.

Descriptors: *Legislation, *Constitutional law, *Michigan, *Natural resources, *Watercourses (Legal aspects), Water users, Water law, Administrative agencies, Regulation, Rivers, Water sports, Pollution abatement, Wildlife conservation, Boating, Legal aspects, River regulation, Control, Control systems, Management, Penalties (Legal), Water rights. Identifiers: Administrative regulations.

Plaintiff boat and canoe livery operators brought this section against defendant commission seeking a temporary injunction against enforcement of proposed rules regulating watercraft and liveries on the AuSable, Manistee, Pine and Pere Marquette Rivers and also seeking a declaratory judgement as to the validity of the proposed rules. The plaintiffs contended the proposed rules denied them several constitutional rights and exceeded the commission's authority. The Michigan Court of Appeals found that the legislature had not specified the method by which the commission was to effectuate its purpose nor what type procedures were to be contemplated. Since the rules, which were promulgated pursuant to legislative statute delegating complete control of wildlife preservation and of pollution prevention in state waters, failed to provide the defendant with any workable standards by which to perform the task, the rules were void and of no force or effect. (Welch-Florida) W76-06543

COMSTOCK V. WHELOCK ('HIGHWAY BY USER' STATUTE NOT APPLICABLE TO GIVE PUBLIC PRESCRIPTIVE RIGHT TO LAKE PROPERTY). 234 NW2d 448-52 (Mich. Ct. App. 1975). 5 p.

Descriptors: *Docks, *Easements, *Prescriptive rights, *Michigan, *Public rights, Public access, Public benefits, Legal aspects, Trespass, Judicial decisions, Right-of-way, Scenic easements,

WATER RESOURCES PLANNING—Field 6

Nonstructural Alternatives—Group 6F

April 1975. 38 p.

Descriptors: *Cooperatives, *Wisconsin, *Lakes, *Management, *Legislation, Legal aspects, State governments, Water quality control, Protection, Grants, Cost-sharing. Identifiers: *Lake rehabilitation, Property owners, Lake districts.

Wisconsin chapter 301, laws of 1973, established a joint state-local program for public lake management. Its primary goals were to protect and improve the quality of Wisconsin's lakes, to evaluate and implement various techniques of lake management, and to compile basic lake data. The lake management program involves gathering information on lake problems and identification of the causes, consideration of remedial measures, development of a plan with alternative courses of action, selection of the most feasible rehabilitation and protection proposal, and implementation of the program. To be qualified the water body must be 'accessible to the public via contiguous public lands or easements giving public access.' To be eligible projects must be for protection and rehabilitation, not cosmetic approaches which deal with symptoms but not causes of lake problems. The law provides technical and financial assistance from the state, but lake protection and rehabilitation must be initiated and carried out at the local level by a lake protection and rehabilitation district. The organization, governing body, financial powers, state aids, and boundaries of lake districts are delineated. The petition and resolution methods of lake district formation are compared. (Buchanan-Davidson--Wisconsin). W76-06632

6F. Nonstructural Alternatives

ECONOMIC AND LEGAL ANALYSIS OF ALTERNATIVE FLOOD CONTROL STRATEGIES: PHASE I, Massachusetts Univ., Amherst. Dept. of Food and Resource Economics. J. H. Foster, and C. Willis. Available from the National Technical Information Service, Springfield, Va. 22161 as PB-251 552 \$3.50 in paper copy, \$2.25 in microfiche. Massachusetts Water Resources Research Center, Amherst, Completion Report, September 1974, 15 p. ORWT B-028-MASS(3).

Descriptors: *Flood control, *Legal aspects, *Economics, *Alternative planning, *Risks, Connecticut River, Flood plains, Land use, Operations research, *Flood plain insurance, Structures, *Flood protection.

The five sub-projects of Phase I have been completed. The accomplishments of each sub-project are separately summarized. They are: Flood Proofing Decisions Under Uncertainty: An Application to the Connecticut River Basin; Flood Plain Land Use Management: An Application of Operations Research Methodology; Flood Insurance and Individual Behavior Under Uncertainty with Policy Implications; Structural Methods of Flood Control; and Legal Aspects of Flood Water Management. W76-06159

FLOOD PLAIN INFORMATION: NORTH FORK ST. LUCIE RIVER, ST. LUCIE COUNTY, FLORIDA. Army Engineer District, Jacksonville, Fla. For primary bibliographic entry see Field 4A. W76-06282

FLOOD PLAIN INFORMATION: UVAS-CARNADERO CREEK, PAJARO RIVER TO UVAS RESERVOIR, SANTA CLARA COUNTY, CALIFORNIA. Army Engineer District, San Francisco, Calif. For primary bibliographic entry see Field 4A.

Highways, Prescriptive rights, Water law, Riparian rights, Recreation, Boat-launching ramps.

Plaintiff property owners brought suit to halt construction by defendant adjacent landowner of a boathouse upon defendant's property which allegedly had been used by the plaintiffs and the general public for over seventy years for swimming, boating, snowmobiling and generally for access to a lake. The plaintiffs contended the property had been used and dedicated as a public highway under the 'highway by user' statute and that they had thus acquired prescriptive easement rights upon the property. The Michigan Court of Appeals held that the public could not obtain prescriptive rights in property which was used for solely recreational purposes. The court agreed with the plaintiffs that the public could acquire rights in a private roadway under the doctrine of 'highway by user', but held that in this situation the elements of the cause of action had not been met, namely: (1) a defined line used and worked upon by public authorities, (2) travelled by the public for 10 consecutive years without interruption, and (3) with such public usage open, notorious and exclusive. The court further held that such a suit could properly be brought only by public officials. This plaintiff had no standing even to assert public rights. (Welch-Florida) W76-06544

HARRIS V. BD. OF WATER AND SEWER COMM'N (RECOVERY FOR FIRE DAMAGE TO RESTAURANT FROM LACK OF WATER IN FIRE HYDRANT). 320 So2d 624-31 (Ala. 1975). 8 p.

Descriptors: *Public utilities, *Hydrants, *Alabama, *Water contracts, *Dependable supply, Pumped storage, Water delivery, Water management(Applied), Water supply development, Water users, Human population, Hydrants, Equipment, Discharge(Water), Pipes, Water works, Judicial decisions, Legal aspects, Penalties(Legal), Governments, Municipal water, Water supply. Identifiers: Sovereign immunity.

Plaintiff motel and restaurant owner brought this action against defendant board of water and sewer commissioners to recover for fire loss allegedly incurred by defendant's failure to properly maintain the public fire hydrant and supply of water to it in accordance with the contract between the defendant and the city of Mobile. The plaintiff contended he could sue for breach of that contract as a third party beneficiary; furthermore, by failing to use reasonable care in supplying water the defendant had breached its duty to the plaintiff. The Alabama Supreme Court agreed that plaintiff could sue on the contract as a third party beneficiary and that defendant did not enjoy the traditional defense of sovereign immunity for its failure to maintain an adequate water supply in the hydrants. The court found that the inadequate water supply was enough to show a breach of defendant's duty to all those within the foreseeable area of risk. (Welch-Florida) W76-06545

FRY V. KAISER (RIGHTS OF OWNERS OF RECORDED PLATS ABUTTING CHANNEL AS COMPARED TO THOSE OF SUBDIVISION DEVELOPER). 232 NW2d 673-77 (Mich. Ct. App. 1975). 5 p, 1 map.

Descriptors: *Michigan, *Land tenure, *Sea walls, *Easements, *Real property, *Channels, Judicial decisions, Legal aspects, Water rights, Management, Retaining walls, Shore protection, Right-of-way.

Plaintiff developer had sold lots in a subdivision bordered by a channel 34 feet in width with a five foot abutting strip of land. Because of the expense

involved in maintaining and repairing the existing seawall, the plaintiff brought this action seeking to have the defendant lotowners declared owners of the channel bottom and of the five foot strip. The plaintiff contended that the recorded plot and warranty deed made it clear that the land in question had been granted to the defendants. The trial court rejected the contention, however, granting summary judgement to the defendants and holding that the plaintiff was responsible for maintaining the seawall. On appeal, the judgement was reversed in part and affirmed in part. The Michigan Court of Appeals found that the wording of the warranty deed made it clear that the defendants' property was to extend only to the channel's edge. The court also found that an express easement to the channel over the five foot strip was granted by the deed. Consequently, since the applicable law provides that an individual who has an easement over another's property is required to maintain and repair it, the court ordered the defendants to reimburse the plaintiff for any money expended in maintaining and repairing the seawall. (Hoffman-Florida) W76-06546

SYSTEMATIC DESIGN OF LEGAL REGULATIONS FOR OPTIMAL SURFACE-GROUND-WATER USAGE - PHASE 2, Colorado State Univ., Fort Collins. Dept. of Civil Engineering. For primary bibliographic entry see Field 4B. W76-06551

ENVIRONMENTAL ASSESSMENT AND DESIGN: PROCEEDINGS OF A SEMINAR. Minnesota Univ., Minneapolis. Water Resources Research Center. For primary bibliographic entry see Field 6G. W76-06555

THE ECOLOGICAL BASIS FOR THE AUGUST 1, 1973 GUIDELINES OF THE COUNCIL ON ENVIRONMENTAL QUALITY, AND SOME IDEAS FOR THE PREPARATION OF ENVIRONMENTAL IMPACT STATEMENTS, Minnesota Univ., Minneapolis. Water Resources Research Center. For primary bibliographic entry see Field 6G. W76-06556

FEDERAL ENVIRONMENTAL IMPACT STATEMENTS--A CASE STUDY, Army Engineer District, St. Paul, Minn. For primary bibliographic entry see Field 6G. W76-06557

ENVIRONMENTAL IMPACT STATEMENTS/ENVIRONMENTAL POLICY ACT--LEGISLATIVE INTENT, Minnesota State Senate, St. Paul. For primary bibliographic entry see Field 6G. W76-06558

MINNESOTA ENVIRONMENTAL IMPACT STATEMENTS--A USERS VIEWPOINT, Minnesota Univ., Minneapolis. Water Resources Research Center. For primary bibliographic entry see Field 6G. W76-06559

MINNESOTA ENVIRONMENTAL IMPACT STATEMENT REQUIREMENTS, Minnesota Univ., St. Paul. Council on Environmental Quality. For primary bibliographic entry see Field 6G. W76-06560

A GUIDE TO WISCONSIN'S LAKE MANAGEMENT LAW. Wisconsin Univ. Extension, Madison.

Field 6—WATER RESOURCES PLANNING

Group 6F—Nonstructural Alternatives

W76-06283

FLOOD PLAIN INFORMATION: STILL AND MAD RIVERS, TOWN OF WINCHESTER, CONNECTICUT.

Corps of Engineers, Waltham, Mass. New England Div.

For primary bibliographic entry see Field 4A.

W76-06284

FLOOD PLAIN INFORMATION: COASTAL AREAS, SARASOTA COUNTY, FLORIDA.

Army Engineer District, Jacksonville, Fla.

For primary bibliographic entry see Field 4A.

W76-06285

FLOOD PLAIN MAPPING,

Hydrocomp, Inc., Palo Alto, Calif.

For primary bibliographic entry see Field 2E.

W76-06312

FLOOD PLAIN INFORMATION: COASTAL AREAS, ST. LUCIE COUNTY, FLORIDA.

Army Engineer District, Jacksonville, Fla.

For primary bibliographic entry see Field 4A.

W76-06354

FLOOD PLAIN INFORMATION: VAN DUZEN RIVER, HUMBOLT COUNTY, CALIFORNIA.

Army Engineer District, San Francisco, Calif.

For primary bibliographic entry see Field 4A.

W76-06355

FLOOD PLAIN INFORMATION: SAN TIMOTEO CREEK, VICINITY OF LOMA LINDA, SAN BERNARDINO COUNTY, CALIFORNIA.

Army Engineer District, Los Angeles, Calif.

For primary bibliographic entry see Field 4A.

W76-06356

FLOOD PLAIN INFORMATION: UPPER ST. VRAIN CREEK, VOLUME IV, BOULDER COUNTY, COLORADO.

Army Engineer District, Omaha, Nebr.

For primary bibliographic entry see Field 4A.

W76-06357

FLOOD PLAIN INFORMATION: SALMON BROOK, EAST BRANCH AND WEST BRANCH, GRANBY AND E. GRANBY, CONNECTICUT.

Corps of Engineers, Waltham, Mass. New England Div.

For primary bibliographic entry see Field 4A.

W76-06358

FLOOD PLAIN INFORMATION: CYPRESS CREEK, ORANGE COUNTY, FLORIDA.

Army Engineer District, Jacksonville, Fla.

For primary bibliographic entry see Field 4A.

W76-06359

FLOOD DAMAGE REDUCTION POTENTIAL OF RIVER FORECAST,

Wisconsin Univ., Green Bay. Coll. of Environmental Science.

H. J. Day, and K. K. Lee.

Journal of the Water Resources Planning and Management Division, Proceedings of the American Society of Civil Engineers, Proceedings Paper No. 12059, Vol. 102, NO. WR1, p 77-87, April 1976. 4 fig, 3 tab, 12 ref.

Descriptors: *Water resources, *Flood control, *Flood damage, *Land use, Simulation analysis, Mathematical models, Zoning, Hydrology, Economics, Flood plains, River basins, Hydraulics, *Connecticut River, Systems analysis, Estimating, Economics.

An analytical method consisting of a set of hydrologic and economic models is presented for estimating expected flood damage reduction due to simulation of flood plain actions in a river basin. The method is based on the interrelationship of the hydraulic and hydrologic features of the flood plain, physical and economic data on flood-plain structures and their contents. Synthetic stage damage curves for individual residential and commercial structures reduces the need for field data. The method was demonstrated in the Connecticut River Basin where many complex urban flood damage centers exist on the main stem as well as on the tributaries. The analysis and interpretation of the results provided an estimate of the potential value of flood warnings in a basin where a river forecast system coupled with an effective citizen response can be one of the most cost-effective alternatives. (Bell-Cornell)

W76-06435

FLOOD PLAIN AND TSUNAMI INUNDATION AREA ORDINANCE.

County of Maui, Hawaii, Ordinance No. 716 (1972). 3 p.

Descriptors: *Hawaii, *Flood plain zoning, *Flood protection, *Floodways, *Tsunamis, Floods, Channels, Flood plains, Rivers, Streams, Floodwater, Maps, Flood profiles, Floodproofing, Structures, Runoff, Reservoirs, Drainage, Agriculture, Obstruction to flow, Right-of-way, Bulkheads, Safety.

Identifiers: Flood fringe, Tsunami inundation district, Flood protection elevation, Hundred-year flood.

This ordinance establishes regulations and development standards in areas subject to flooding or tsunami inundation. Flood Plain Districts are required to be adopted and designated on the official zoning maps of the county. Uses permitted in the floodway, such as agriculture, loading, parking, and recreation, are specified. Other uses are permitted upon application to and approval by the Planning Commission. Certain uses that would reduce the efficiency or the capacity of the floodway are prohibited. Permitted uses in the Flood Fringe are specified, and certain uses in the Tsunami Inundation District, which are prohibited without application to and approval by the Planning Commission, are also specified. Requirements for proposed subdivisions within the Flood Plain District, such as for channel improvement, for channel right-of-way, and for floodproofing, are specified. Also set forth are conditions upon which the use of a structure for a lawful purpose not in conformity with the provisions of this ordinance can be continued. Violation of this ordinance is a misdemeanor. (Segall-Florida)

W76-06492

SAMPLE SUBDIVISION CONTROL ORDINANCE FOR FLOOD HAZARD AREAS.

Minnesota Dept. of Natural Resources, St. Paul.

Sept. 1971. 61 p, 3 fig, append.

Descriptors: *Adoption of practices, *Minnesota, *Flood plain zoning, *Land use, *Legislation, Land classification, Non-structural alternatives, Land management, Water zoning, Flood protection, Floodways, Regulation, Legal aspects, Penalties(Legal), Comprehensive planning, Administration, Multi-purpose projects.

Identifiers: *Plats.

In an effort to reduce the loss of life and property, and other numerous damages caused by the unwise use of flood plains, Minnesota has published a sample zoning ordinance to guide in the development of flood plain areas. The major purpose of the ordinance is to set up safeguards to assure proper land use. Thus, before any sale of land in designated flood plain areas can be consummated, the developer must submit detailed plats to the platting authority. Furthermore, the developer

must convince the authority that the land can be safely used for its intended purpose. The degree of evidence that must be submitted will depend on whether the land is in a floodway area or a flood fringe area. Generally, the only land uses permitted in a floodway zone will be those with low flood damage potential such as agriculture and parking areas. In flood fringe areas, however, the restrictions will not be as severe, and approval of buildings or structures will usually be granted. The ordinance spells out in detail the procedural requirements that must be met in getting a plat approved. It also provides criminal penalties for any violations of its provisions. (Hoffman-Florida)

W76-06494

ENVIRONMENTAL MANAGEMENT FOR THE METROPOLITAN AREA CEDAR-GREEN RIVER BASINS, WASHINGTON, PART II: URBAN DRAINAGE.

Army Engineer District, Seattle, Wash.

For primary bibliographic entry see Field 6G.

W76-06573

THE INFLUENCE OF FLOOD HAZARDS UPON RESIDENTIAL PROPERTY VALUES,

Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Agricultural Economics. D. Damianos.

Available from the National Technical Information Service, Springfield, Va 22161, as PB-251 942, \$7.50 in paper copy, \$2.25 in microfiche. Ph. D. Dissertation, 165 p, 12 tab, 8 fig. OWRT-A-054-Va.

Descriptors: *Flood control, Water resources, Zoning.

Identifiers: Economic Analysis, Floods.

The economic concept of property as a 'bundle of rights' accruing to ownership suggests that public actions to deal with flood hazards can affect the rights to use and, therefore, the economic value of property. Owners of property might be induced to take actions in the public choice process for selection of alternatives that favor actions enhancing property values. To test this proposition, it is necessary to determine the impact alternative flood hazard reduction policies may have upon property values. The objectives of this study are to discuss the theoretical arguments for determining the factors which may influence land value changes induced by flood hazard reduction policies, and to empirically estimate the influence of flood hazard reduction alternatives on property values. The research was divided into three major areas of investigation. The basic source of data was city courthouse and real estate appraisers records.

W76-06643

6G. Ecologic Impact Of Water Development

THE ECONOMIC VALUE OF REMOTE SENSING OF EARTH RESOURCES FROM SPACE: AN ERTS OVERVIEW AND THE VALUE OF CONTINUITY OF SERVICE. VOLUME IX. OCEANS.

Econ. Inc., Princeton, N. J.

For primary bibliographic entry see Field 7B.

W76-06222

A PRE-IMPOUNDMENT STUDY OF THE FISH FAUNA OF INDIAN CREEK, DEKALB COUNTY, ILLINOIS,

Washington Univ., Seattle. Fisheries Research Inst.

For primary bibliographic entry see Field 2E.

W76-06251

EARTHWATCH,
National Oceanic and Atmospheric Administration,
Rockville, Md. Deep Water Ports Project Of-
fice.
For primary bibliographic entry see Field 5A.
W76-06321

**HOW THE GREAT LAKES WERE EVALU-
ATED,**
Great Lakes Basin Commission, Ann Arbor,
Mich.
For primary bibliographic entry see Field 5G.
W76-06329

**SYSTEMATIC APPROACHES TO ENVIRON-
MENTAL IMPACT ASSESSMENT: AN
EVALUATION,**
Ohio State Univ., Columbus. Dept. of Civil En-
gineering.
E. E. Whitlatch, Jr.
Water Resources Bulletin, Vol. 12, No. 1, p 123-
137, February 1976. 3 fig, 1 tab, 25 ref.

Descriptors: *Environmental effects,
*Assessment, *Evaluation, Decision making,
Water resources, Projects, Mathematical models,
Systems analysis.
Identifiers: *Environmental impact, Linear vector
model, Nonlinear evaluation.

Increased public awareness of the environmental effects of large-scale projects and concomitant public participation in the environmental impact assessment process demand that assessment methods and procedures fulfill a wide range of desirable characteristics. These are developed and offered as specific criteria against which currently proposed environmental assessment procedures should be judged. Such procedures as checklists, matrices, networks (stepped matrices), overlays, linear vector analysis, and nonlinear evaluation systems are presented and judged in light of the proposed criteria. It is concluded that the use of checklists, the most common assessment format used to date, does not constitute a viable assessment procedure. Use of the matrix or stepped matrix techniques in conjunction with the linear vector or non-linear evaluation systems, with the latter modified slightly, is seen as an approach to environmental assessment that will achieve most of the established criteria. (Bell-Cornell)
W76-06431

**PLANNING AND SELECTING MULTIOBJEC-
TIVE PROJECTS BY GOAL PROGRAMMING,**
Wesleyan Coll. Macon, Ga.
For primary bibliographic entry see Field 6A.
W76-06432

**DECISIONS FOR DELAWARE: SEA GRANT
LOOKS AT LEGAL ASPECTS OF OCS
DEVELOPMENT,**
Delaware Univ., Newark. Center for the Study of
Marine Policy.
For primary bibliographic entry see Field 6E.
W76-06485

**THE COMMON LAW OF PUBLIC NUISANCE
IN STATE ENVIRONMENTAL LITIGATION,**
For primary bibliographic entry see Field 6E.
W76-06488

**THE NATIONAL ENVIRONMENTAL POLICY
ACTS FIRST FIVE YEARS,**
National Aeronautics and Space Administration,
Moffett Field, Calif. Ames Research Center.
S. L. Deutsch.
Environmental Affairs, Vol. 4, p. 3-80 (1975). 78 p,
430 ref.

Descriptors: *Project planning, *Environmental effects,
*Legal review, *Water quality control,

*Environmental control, Legislation, Legal aspects, Water law, Planning, Regulation, Administration, History, Comprehensive planning, Governmental interrelations, Water policy, Federal jurisdiction, Federal government, Adoption of practices, Judicial decisions.
Identifiers: *Environmental Impact State-
ment(EIS), *National Environmental Policy Act.

A survey is presented of the requirements of the National Environmental Policy Act (NEPA) within the framework of relevant federal guidelines and court decisions of major significance reported prior to January 1, 1975. The first section of the article analyzes the Act as passed by Congress together with the applicable executive orders and Council on Environmental Quality regulations which have interpreted it. The second section deals with judicial interpretation of NEPA, and discusses various topics involved with this interpretation, including: (1) threshold issue; (2) adequacy of the environmental impact statement; (3) other rights created by NEPA; and (4) substantive rights under the NEPA. One of the most publicized and litigated provisions of NEPA is the procedural mandate which requires the issuance of an environmental impact statement to accompany every report on proposals for legislation and other major Federal actions significantly affecting the quality of the human environment. Because of the pervasive impact this requirement has put on all major development projects, special emphasis and consideration is given to judicial interpretation of the phrase 'major Federal action significantly affecting the quality of the human environment'. Emphasis is also placed on what the courts have required as to the adequacy of facts and information presented in the environmental impact statements. (Hoffman-Florida)
W76-06490

**SIERRA CLUB V. MORTON (PROHIBITION OF
DAMS AND DIKES ACROSS NAVIGABLE
WATERS UNDER RIVER AND HARBORS ACT
OF 1899).**
For primary bibliographic entry see Field 6E.
W76-06540

**ENVIRONMENTAL ASSESSMENT AND
DESIGN: PROCEEDINGS OF A SEMINAR.**
Minnesota Univ., Minneapolis. Water Resources
Research Center.
Available from the National Technical Informa-
tion Service, Springfield, Va., 22161, as PB-251
909, \$4.50 in paper copy, \$2.25 in microfiche. Bul-
letin No. 78, January 1975, 54 p. OWRT A-999-
MINN(34)

Descriptors: *Minnesota, Design, Planning,
*Environmental effects, Water quality standards,
*Legislation, Legal aspects.
Identifiers: *Environmental Impact Statement.

The purpose of this publication is to provide information on Federal and State (Minnesota) environmental impact statement requirements. Topics discussed include the intent of the environmental impact legislation, projects which require impact statements, and information which should be included in environmental impact statements. Case studies detailing positive and negative aspects of the environmental impact statement process are presented. (See W76-06556 thru W76-06560) (Waelti-Minnesota)
W76-06555

**THE ECOLOGICAL BASIS FOR THE AUGUST
1, 1973 GUIDELINES OF THE COUNCIL ON
ENVIRONMENTAL QUALITY, AND SOME
IDEAS FOR THE PREPARATION OF EN-
VIRONMENTAL IMPACT STATEMENTS,**
Minnesota Univ., Minneapolis. Water Resources
Research Center.
B. E. Willard.
In: Minnesota Water Resources Research Center,
Bull 78, p. 1-10, January 1975. 11 p.

Descriptors: *Balance of nature, *Comprehensive planning, *Ecosystems, *Environmental effects, Niches, Economics, Evaluation, Conservation, Decision making, Project planning, Food chains, Engineering, Environmental engineering, Biology, Evolution, Path of pollutants, Pollutants, Pollution abatement, Limiting factors, Alternate planning, Ecology.
Identifiers: *Environmental Impact Statements, National Environmental Policy Act.

This report evaluates guidelines for Environmental Impact Statements established by the Council on Environmental Quality as tools for continuing the policy of the Federal Government to use all practicable means and measures in a manner calculated to create and maintain conditions under which man and nature can exist in productive harmony. These guidelines are based on the premise that everything on earth affects everything else, directly or indirectly. Nothing operates in isolation. Ecological-environmental research should be commenced even before projects are conceived. This research should be conducted from the holistic viewpoint to determine the overall long-range environmental repercussions of any project. The '3E's' (engineering, ecology and economics) should be considered as a unit, mutually supportive of one another. Potential alternative sites and alternative means of accomplishing projects should be objectively evaluated so that the project can be accomplished with minimal adverse environmental effects. (See also W76-06555) (Nursey-Florida)
W76-06556

**FEDERAL ENVIRONMENTAL IMPACT
STATEMENTS--A CASE STUDY,**
Army Engineer District, St. Paul, Minn.
R. F. Post.
In: Minnesota Water Resources Research Center,
Bull 78, p. 11-28, January 1975. 18 p, 2 map, 1 tab,
2 chart.

Descriptors: *Environmental effects, *Decision making, *Cost-benefit analysis, *Project planning, Economics, Evaluation, Conservation, Engineering, Environmental engineering, Environmental control, Balance of nature, Economic justification, Social impact, Economic feasibility, Economic impact, Social values, Pollutants, Water pollution effects, Pollution abatement, Alternate planning, Federal government, Turbidity.
Identifiers: *Environmental Impact Statement.

This report discusses Environmental Impact Statements prepared by the Corps of Engineers for two separate projects. These case studies are used to illustrate the procedure followed by the Corps of Engineers in preparing Environmental Impact Statements. The author states that in preparing these statements, the Corps attempts to develop proposals to balance the environmental developmental needs of the nation. The Corps considers the following factors: the possible detrimental effects of the proposed project on the environment of the area; the costs and impact of various alternative methods of carrying out the project; the costs to be incurred and benefits to be received from the economic and social effects of the proposed project. After considering all of these factors, the Corps must then make a final determination whether to recommend approval or disapproval of the proposed project. (See also W76-06555) (Nursey-Florida)
W76-06557

**ENVIRONMENTAL IMPACT STATE-
MENTS/ENVIRONMENTAL POLICY ACT-
LEGISLATIVE INTENT,**
Minnesota State Senate, St. Paul.
W. Borden.
In: Minnesota Water Resources Research Center,
Bull 78, p. 29-35, January 1975. 6 p.

Field 6—WATER RESOURCES PLANNING

Group 6G—Ecologic Impact Of Water Development

Descriptors: *Minnesota, *Project planning, *Environmental effects, Economics, Evaluation, Conservation, Decision making, Engineering, Environmental engineering, Pollutants, Pollution abatement, Economic impact, Social impact, Legislation, Social values, Ecology, Environmental control, State governments, Federal government.

Identifiers: *Environmental Impact Statement, *State policy, National Environmental Policy Act, Chapter 412 of Minnesota Laws of 1973, Injunctions(Prohibitory).

This report discusses the legislative intent of Chapter 412 of Minnesota Laws 1973. The stated purposes of the law are: (1) to declare a state policy that will encourage productive harmony between man and his environment; (2) to promote efforts that will prevent or eliminate damage to the environment; and (3) to enrich the understanding of ecological systems and natural resources important to the state or nation. The author states that it is the intent of the law to force developers and governmental units to seriously consider the immediate and future social, economic and environmental impact of proposals, to insure public input, and to provide a procedure for evaluating, and if necessary, halting injurious projects. The intent of this law can be carried out through the use of Environmental Impact Statements, public hearings on draft statements, and enforcing permit refusals with the necessary court action to enjoin construction of disapproved projects. The author concludes that this system is not state land use planning in disguise; the system allows local initiative, but places environmental checks on it. (See also W76-06555) (Nursey-Florida) W76-06558

MINNESOTA ENVIRONMENTAL IMPACT STATEMENTS—A USERS VIEWPOINT, Minnesota Univ., Minneapolis. Water Resources Research Center. G. C. Hite.

In: Minnesota Water Resources Research Center Bulletin 78, p. 43-54, January 1975. 12 p.

Descriptors: *Minnesota, *Project planning, *Economic impact, *Costs, State governments, Federal government, Environmental control, Legislation, Environmental engineering, Investment, Social impact, Economics, Profit, Capital costs, Financing, Conservation, Environmental effects.

Identifiers: *Environmental Impact Statement, *Minnesota Environmental Policy Act, National Environmental Policy Act.

This report discusses the effects of state environmental impact statements requirements on the land development business in Minnesota. The author states that due to environmental restrictions, many excellent development sites will no longer be available for construction. Sites that will be available are expected to cost significantly more. The author also states that because many of the new review areas are susceptible to a highly subjective judgement analysis, there is an increased uncertainty about public approval of the proposal. Both of these factors will lead to increased land development costs and the possibility of a decrease in return on investment. The author further states that the Minnesota requirements will give a competitive advantage to those companies which have developed in the environmental sciences. The author, however, generally praises the Minnesota Environmental Impact Statement requirements for eliminating or modifying many of the problem areas of the federal law. The author concludes that environmental consciousness is maturing in this country and that good business practices and good environmental practices are consistent and should be mutually supportive. (See also W76-06555) (Nursey-Florida) W76-06559

MINNESOTA ENVIRONMENTAL IMPACT STATEMENT REQUIREMENTS, Minnesota Univ., St. Paul. Council on Environmental Quality.

J. Mohr.

In: Minnesota Water Resources Research Center, Bull 78, p. 36-42, January 1975. 7 p.

Descriptors: *Minnesota, *Project planning, *Decision making, *Environmental effects, Economics, Evaluation, State governments, Federal government, Legislation, Conservation, Engineering, Environmental engineering, Pollution abatement, Cost-benefit analysis, Economic impact, Social impact, Social values, Environmental control, Economic justification, Alternate planning.

Identifiers: *Environmental Impact Statement, *Minnesota Environmental Policy Act, National Environmental Policy Act.

This report discusses the Minnesota environmental impact statement process. Although the Minnesota Environmental Policy Act is modeled after the National Environmental Policy Act of 1969, the impact statement requirements in the Minnesota Act go beyond the requirements of the Federal Act. The Minnesota Act requires preparation of Environmental Impact Statements on 'major public actions with the potential of significant environmental effects' or 'major private actions of more than local significance with the potential for significant environmental effects'. The law also provides for a procedure whereby persons can petition for the requirement of an impact statement on a given project. The Environmental Impact Statements must include: (1) a description of the project; (2) the environmental impact of the proposed project, including a description of the resources in the area that will be affected, any direct or indirect environmental, economic and employment effects and any irreversible and irretrievable commitments of resources that would be involved; (3) alternatives to the proposed project; (4) impact on state government of any federal controls associated with the proposed project; (5) the multi-state responsibilities associated with the proposed action; and (6) organizations and persons consulted. (See also W76-06555) (Nursey-Florida) W76-06560

ENVIRONMENTAL MANAGEMENT FOR THE METROPOLITAN AREA CEDAR-GREEN RIVER BASINS, WASHINGTON, PART II: URBAN DRAINAGE.

Army Engineer District, Seattle, Wash. December 1974. 107 p, 75 fig, 24 tab, 160 ref, glossary. DACW 67-76-C-0002.

Descriptors: Planning, *Non-structural alternatives, Water management(Applied), *Drainage systems, Water resources, Social impacts, *Environmental effects, Government, *River Basin Development, Land management, *Comprehensive planning, *Urban drainage, Storms, Runoff, *Washington, Legislation, Zoning, Land use.

Identifiers: Green River(WA), Cedar River(WA), River Basin Coordination Committee(RIBCO), Seattle(WA).

This report contains the results of the overall study and establishes the basis for the study recommendations. A coordinated basin-wide approach to storm water management is recommended in order to protect and preserve the area streams in as natural a state as possible. A drainage plan detailing the combination of control methods suitable for the regional sub-basins and including a procedure for implementation should be worked out. Opinions of citizens in each sub-basin should be reflected in the plan. A common set of guide lines, permit procedures and drainage management requirements should be developed for the two counties. An equitable service charge should be the primary source of funds with State

and Federal funds considered as additional sources where available. Construction of the 31 drainage facilities listed is recommended only after additional detailed design and coordinated planning are completed. Open natural drainage, wet lands and holding ponds should be preserved wherever practical. Flood plain zoning and site development ordinances should be used to control drainage and runoff. The study includes the River Basin Coordinating Committee, the environmental management program, the study area, environmental problems related to urban drainage, basis and methodology used for development of alternative plans, community involvement, and jurisdictional and financial aspects. (Hufschmidt - North Carolina) W76-06573

KANEOCHE ALTERNATIVES: AN APPLICATION OF IMPACT METHODOLOGY.

Hawaii Environmental Simulation Lab., Honolulu. Available from the National Technical Information Service, Springfield, Va 22161 as PB-240 736, \$5.50 in paper copy, \$2.25 in microfiche. Prepared for the National Science Foundation, Washington, D.C. 1974. 134 p, 1 fig, 10 tab, 32 plates, 17 ref. GI-36224.

Descriptors: Planning, *Non-structural alternatives, *Alternative planning, *Future planning(Projected), Model studies, Projections, Social aspects, Environmental effects, *Urban drainage, Urbanization, *Land use, Growth rates, Water resources development, Water quality, Water distribution, *Hawaii, Methodology. Identifiers: *Kaneohe Bay(HI), Oahu(HI).

This report represents a broad range of information related to alternative futures for the Kaneohe Bay region in northeastern Oahu Island, Hawaii. The study develops, improves and demonstrates a variety of planning methods of environmental assessment useful to evaluate consequences of urban growth. Based on different assumptions about the type, pace and scale of urban development, three scenarios are projected for 1995: (1) assume the existing general plan for the region guides development; (2) private developers plans indicate land use change; and (3) limits to those areas which appear environmentally suitable for urbanization. An overview of the study area is presented, followed by an analysis of the environmental impact of the alternative policies on urban land and water resources uses. Carrying capacity, overload capacity and need to retain flexibility and adaptability in planning tools serve as evaluative criteria for the scenarios. Simulation models, representing a wide diversity of geographic, hydrologic and site development factors were developed to project possible environmental consequences. These models included Small Watershed Peak Discharge Model, Universal Soil Loss Equation, Sewer Alignment Model and Sewer Network Volume/Capacity Model. Water problems were identified to be water distribution and water quality. Each scenario provides alternatives for waste water treatment, flood protection and water distribution and measures their costs. Community interaction and social impact assessment of each scenario are discussed. (Salzman - North Carolina) W76-06574

DYNAMICS OF MARSH LAND FORMATION AND SUCCESSION ALONG THE LOWER COLORADO RIVER AND THEIR IMPORTANCE AND MANAGEMENT PROBLEMS AS RELATED TO WILDLIFE IN THE ARID SOUTHWEST.

Arizona State Univ., Tempe. For primary bibliographic entry see Field 4A. W76-06589

THE RATIONALE OF NOMAD ECONOMY, Uppsala Univ. (Sweden).

For primary bibliographic entry see Field 4C.

W76-06591

DESERTIFICATION: A WORLD PROBLEM,
Worldwatch Inst., Washington, D.C.
For primary bibliographic entry see Field 4C.
W76-06592

THE MEDICINE BOW ECOLOGY PROJECT:
THE POTENTIAL SENSITIVITY OF VARIOUS
ECOSYSTEM COMPONENTS TO WINTER
PRECIPITATION MANAGEMENT IN THE
MEDICINE BOW MOUNTAINS, WYOMING,
Wyoming Univ., Laramie.
For primary bibliographic entry see Field 5C.
W76-06610

AN ASSESSMENT OF THE EXPECTED IMPACT OF A DREDGING PROJECT PROPOSED FOR PALA LAGOON, AMERICAN SAMOA,
Hawaii Univ., Honolulu. Sea Grant Program.
P. Helfrich, J. L. Ball, Jr., P. Bienfang, M. Foster, and B. Gallagher.
UNIH-SEAGRANT-TR-76-02, October 1975. 76 p., 18 fig., 7 tab., 49 ref., 5 append., \$2.50. Grant 2-35243.

Descriptors: *Dredging, Environment, *Environmental effects, Channel improvement, Aquatic life, Aquatic environment, Biota, Ecosystems, Biology, Ecology, Marine biology, Lagoons, *Social impact, *Economic impact, Pacific Ocean, Water pollution effects.
Identifiers: *Pala Lagoon(American Samoa).

Biological and socio-economic effects are assessed of a dredging project proposed for Pala Lagoon, American Samoa. Emphasis is placed on the expected impact the project would have upon the tides and circulation, bacterial contamination, phytoplankton productivity, coral and echinoderms, and fishes of Pala Lagoon. The data collected indicate that dredging would remove an existing sill and, although the volume flow through the entrance channel would be increased, the turbulent mixing process between ocean and lagoon would be decreased, and, as a result, the average residence time of water in the lagoon would be increased. Since the dredging is not believed to enhance the effective tidal dilution, this project is not expected to improve the microbial quality of the lagoon. Any perturbations affecting the coral (such as dredging) can be expected to have a profound effect on the rest of the community for an extended period. Increased residence time of water in the lagoon, caused by dredging, would be detrimental to delicate fish larvae. (NOAA)
W76-06654

7. RESOURCES DATA

7A. Network Design

REMOTE SENSING OF RESOURCES IN ARID LANDS,
Arizona Univ., Tucson. Office of Arid Lands Studies.
J. D. Johnson, L. K. Lepley, and K. E. Foster.
Proceedings in: International Seminar on Land Evaluation in Arid and Semi-Arid Zones of Latin America, Rome, February 4-7, 1974. p. 65-77 1975, 34 ref.

Descriptors: *Remote sensing, *Arid lands, *Satellites(Artificial), *Water resources, *Mapping, Arizona, Resources, Aerial photography, Infrared radiation, Radar, Terrain analysis, Surveys, Hydrology, Vegetation, Land use, Fossil fuels, Natural resources, Photography, Computers.
Identifiers: Tortolita project(Ariz), Composite computer mapping.

Increasing population pressures in congested areas have led to new interest in sparsely populated arid lands. This interest is largely due to advances in water technology that may greatly change a capacity of deserts to support more people. Remote sensing, the science of acquiring information through devices such as cameras, radar, lasers, thermal infrared sensors, and other instruments remote from that which is being measured should lead to better resource management and inventory techniques. Management of arid lands resources requires a 3-step process: inventory, analysis, and operations or development. Aspects of remote sensing as they apply to arid land resource inventory are discussed. Photographic capabilities (including multiband photographs, multiband photographs, and multistage photographs) of the Earth Resources Technology Satellite (ERTS) are reviewed. Major resource applications of remote sensing include hydrology and water resources, vegetation, soil resources, minerals and fossil fuels, marine resources, land use, and land use changes. The use of computer mapping as a data handling technique in conjunction with remote sensing is discussed. A brief description of the Tortolita project in Arizona is included. The composite computer mapping technique is described in 3 steps: (1) select relevant factors, (2) construct functional groups and assign weights, and (3) assign weights to individual factor maps. (Robinet-Arizona)
W76-06260

DATA COLLECTION SYSTEMS AND THEIR IMPACT ON THE FUTURE DEVELOPMENT OF HYDROLOGY.
Department of the Environment, Reading (England). Water Data Unit.
J. C. Rodda.
Water Services, Vol. 79, No. 947, p 10-15, January 1975. 5 fig., 26 ref.

Descriptors: *Data storage and retrieval, *On-site data collections, *Satellites(Artificial), *Remote sensing, Hydrology, *Hydrologic data, *Data collections, Automatic control, Compute models, Simulation analysis, Water resources, Snow surveys.
Identifiers: Delaware River Basin(MD), Thetford Forest(United Kingdom).

Some recent advances in hydrolog are examined. Integrated data collection systems are becoming more frequent, yet these systems range in complexity from single measuring devices which continuously measure a single variable to systems which record vast amounts of information over wide areas and transmit to one or more bases. Examples are cited. (1) In the Thetford Forest (United Kingdom) a project is being undertaken to establish the evaporative characteristics of Scots pine through the use of a computer-controlled data acquisition system and simulation model. Thirty meter towers carry pairs of aspirated quartz crystal, wet and dry bulb thermometers, anemometers and wind vanes. The computer collects observations from 110 sensors and lists hourly averages and draws profiles. (2) Snow surveys are being made by satellite to determine extent, depth, and water equivalent of snow. By using infrared sensors and photographs, on flat terrain extent of snow could be determined within 20 km and mountainous terrain within 150-200 m. (3) In order to predict stream flow following rainfall, radar is being used to continuously monitor a water basin in the United Kingdom. The radar information is calibrated through the use of a computer model. Flow forecasts are highly accurate. (4) In the Delaware River Basin (MD) satellite-based collection is supplementing more traditional data collection methods to give data on water quantity, dissolved oxygen, temperature, conductivity and pH. Five aspects of systems and data are becoming crucial: reliability, representativeness, impartiality, relevance, and continuity. During the next several decades it is likely these systems will be consolidated. (Smith - North Carolina)
W76-06277

EARTHWATCH,
National Oceanic and Atmospheric Administration, Rockville, Md. Deep Water Ports Project Office.
For primary bibliographic entry see Field 5A.
W76-06321

DEVELOPMENT OF AN EXPERIMENTAL HYDROMETEOROLOGICAL DATA COLLECTION NETWORK,
Western Scientific Services, Inc., Fort Collins, Colo.
For primary bibliographic entry see Field 2B.
W76-06606

LAKE HURON BEGINNING-OF-MONTH WATER LEVELS AND MONTHLY RATES OF CHANGE OF STORAGE,
National Oceanic and Atmospheric Administration, Boulder, Colo. Environmental Research Labs.
For primary bibliographic entry see Field 2H.
W76-06657

AGRICULTURAL DROUGHT OF 1972 KHARIF SEASON,
Meteorological Office, Poona (India).
For primary bibliographic entry see Field 2B.
W76-06681

A SIMPLE RAIN-GAUGE FOR DENSE NETWORK RESEARCH,
Newport Grammar School, Essex (England).
For primary bibliographic entry see Field 2B.
W76-06694

7B. Data Acquisition

BULK DENSITY SAMPLER FOR DEEP SOIL PROFILES,
California Univ., Riverside.
K. M. Holtzclaw, J. M. Rible, and P. F. Pratt.
Soil Science Society of America Proceedings, Vol. 39, No. 6, p 1220-1223, November-December 1975. 4 fig., 2 tab., 3 ref. NSF GI 34733X.

Descriptors: *Sampling, *Bulk density, *Instrumentation, *Soils, *Soil profiles, Drilling, Drilling equipment, Fertilizers, Irrigation, Salts.
Identifiers: *Deep soil profiles, Soil samples, Drilling unit, Soil core method, Soluble ions, Bucket auger.

A bulk density sampler, adapted from a conventional commercial type, was constructed and used to obtain soil samples at more than 50 sampling sites from depths to 30 m. This sampler increased the speed with which samples were taken because it was readily added to or detached from the drilling unit between sequences of drilling. Evaluations showed that the sampler obtained bulk density values quite comparable to those found with an undisturbed soil core method. (Roberts-ISWS)
W76-06171

MEASUREMENT OF THE STRUCTURE OF RIVER FLOW,
Akademiya Nauk SSSR, Moscow. Institut Vodnykh Problem.
For primary bibliographic entry see Field 2E.
W76-06180

MEASUREMENT OF SMALL STRAIN-RATES OVER SHORT TIME PERIODS,
Department of the Environment, Ottawa (Ontario). Inland Waters Directorate; and Department of the Environment, Ottawa (Ontario). Glaciology Div.
For primary bibliographic entry see Field 2C.
W76-06184

Field 7—RESOURCES DATA

Group 7B—Data Acquisition

THE ECONOMIC VALUE OF REMOTE SENSING OF EARTH RESOURCES FROM SPACE: AN ERTS OVERVIEW AND THE VALUE OF CONTINUITY OF SERVICE. VOLUME IX. OCEANS.

Econ, Inc., Princeton, N. J.
Available from the National Technical Information Service, Springfield, Va 22161 as N75 14214, \$6.00 in paper copy, \$2.25 in microfiche. National Aeronautics and Space Administration, Report NASA-CR-141270, December 1974. 133 p. 8 fig., 17 tab. NASW-2580

Descriptors: *Economic impact, *Benefits, *Remote sensing, *Resources, *Oceans, Oceanography, Satellites(Artificial), Weather forecasting, Marine plants, Polar regions, Data collections, Fish management, Mapping, Conservation, Ice, Navigation, Forecasting, Tides, Hurricanes, Currents(Water), Oil pollution, Marine fisheries, Navigation, Coasts, Shore protection, Water pollution control, Estuaries, Law enforcement, Regulation, Monitoring, Legal aspects, *Marine resources, Coastal zone management.

Satellite imagery permits study to a depth of about sixty meters below the ocean surface, the part of the sea which most affects mankind and which he most affects. Almost all important ocean parameters can be sensed from satellites or communicated via satellite using Data Collection Platforms. Satellite imagery is valuable in mapping oceans, ice and polar caps, and water temperature; monitoring food supplies, tides, currents, and oil slicks; optimizing ocean fisheries management and shipping routes; improving coastal zone management and shoreline protection; controlling ocean pollution; and reducing loss of ocean resources due to man-made changes. Remote sensing enhances research on ocean parameters and estuarine ecology. It can be used to design and enforce national and international regulations and agreements. Cost-saving benefits are quantified and user demand for information identified; unquantified benefits are significant. The primary factor making quantification difficult is that the information obtained will be of greatest benefit as input to forecasting models which are yet to be constructed. Applicable federal budgets for specific agencies and laws and statutes governing remote sensing of oceans are summarized. Hard benefits would range from \$6.78-17.04 million. (Buchanan-Davidson--Wisconsin)
W76-06222

WATER CONTENT AND BULK DENSITY CHANGES IN A SOIL PEDON MEASURED WITH DUAL ENERGY GAMMA-RAY TRANSMISSION.

Agricultural Research Service, Phoenix, Ariz. Water Conservation Lab.
For primary bibliographic entry see Field 5G.
W76-06238

REMOTE SENSING OF RESOURCES IN ARID LANDS.

Arizona Univ., Tucson. Office of Arid Lands Studies.
For primary bibliographic entry see Field 7A.
W76-06260

ORBITAL AND HIGH ALTITUDE IMAGERY AS A MANAGEMENT TOOL FOR LAND USE AND FLOOD HAZARD STUDIES.

Arizona Univ., Tucson. Office of Arid Land Studies.
For primary bibliographic entry see Field 4A.
W76-06262

MEASUREMENT IN WATER RESEARCH: PART I.

For primary bibliographic entry see Field 5A.
W76-06310

INSTRUMENTS FOR WATER AND SEWAGE TREATMENT PLANTS (JOGESUIDO KEISO KIKI).

Tokyo Shibaura Electric Co., Ltd. (Japan). K. Sekimoto, K. Nakakuma, M. Ito, T. Hayashi, and H. Hashimoto.
Toshiba Rebyu, (Toshiba Review) Vol. 30, No. 11, p 804-808, October, 1975. 10 fig, 3 tab.

Descriptors: *Water supply, *Waste water treatment, *Equipment, *Instrumentation, Control, Control systems, Monitoring, Measurement, Automation.

The expansion of the scale of water supply and waste water treatment has increased the importance of control equipment for these applications. Descriptions are presented for the newest instruments for water supply and sewage treatment control systems. The equipment includes high-precision electromagnetic flowmeters, maintenance-free water quality sensors, and water meters for centralized reading. (Orr-FIRL)
W76-06347

TRANSMISSOMETER MEASUREMENTS OF THE GREAT LAKES.

Canada Centre for Inland Waters, Burlington (Ontario). K. P. B. Thomson, and J. Jerome.
Scientific Series No. 53, 1975, 10 p, 13 fig, 6 ref.

Descriptors: *Measurements, Investigations, *On-site investigations, Surveys, *Monitoring, Data collections, Limnology, Analysis, *Great Lakes, Instrumentation.
Identifiers: *Transmissometer.

Beginning in 1973 in situ measurements of the optical beam attenuation or transmittance have been obtained on the Great Lakes during the CCIW monitoring cruise program. The instrument used for these measurements and the operational procedure are described. Sample data from each cruise are presented for reference purposes. The transmittance or attenuation data for Lakes Superior, Erie and Ontario are described in terms of their relation to other limnological parameters. Relations observed in the analyses of the optical data show that the beam transmittance or attenuation is an important limnological parameter for the surveillance of the Great Lakes. (Environment Canada)
W76-06370

DETERMINATION OF SNOW DEPTH AND SNOW EXTENT FROM NOAA 2 SATELLITE VERY HIGH RESOLUTION RADIOMETER DATA.

National Environmental Satellite Service, Washington, D.C.
For primary bibliographic entry see Field 2C.
W76-06383

CHROMATOGRAPHIC DETERMINATION OF DMA AND DMF IN AQUEOUS MEDIUM.

Vysoka Skola Chemicko-Technologica, Prague (Czechoslovakia). Dept. of Petroleum Technology and Petrochemistry.
For primary bibliographic entry see Field 5A.
W76-06390

SEMI-AUTOMATED AMMONIA PROBE DETERMINATION OF KJELDAHL NITROGEN IN FRESHWATERS.

Ministry of Agriculture, Antrim (Northern Ireland). Freshwater Biological Investigation Unit.
For primary bibliographic entry see Field 5A.
W76-06391

A COMPARISON OF THE RESPONSES OF IDENTICAL CUP ANEMOMETERS MOUNTED ON A SPAR AND A TOROID BUOY.

Oregon State Univ., Corvallis. School of Oceanography.
W. V. Burt.
Journal of Physical Oceanography, Vol. 5, No. 4, p 789-792, October 1975. 4 fig, 13 ref. NSF OCD71-00271 A05.

Descriptors: *Anemometers, *Winds, *Instrumentation, Buoys, Waves(Water), Statistical methods, Wind velocity, Oceans.
Identifiers: *Errors, Standard deviation, Spar buoys, Toroid buoys.

In experiments with identical cup anemometers, one mounted on a spar buoy and one mounted on a toroid buoy that were anchored close together, the anemometer mounted on the toroid indicated consistently higher 10-min integrated averages of wind speed than the cup anemometer mounted on the spar buoy. The difference was 7% of the mean wind speed and was linear over a range of mean wind speeds from 1.5 to 9.5 m/s. (Jones-ISWS)
W76-06392

CLASSIFICATION OF WETLANDS VEGETATION USING SMALL SCALE COLOR INFRARED IMAGERY.

Smithsonian Institution, Edgewater, Md. Chesapeake Bay Center for Environmental Studies.
For primary bibliographic entry see Field 2L.
W76-06411

PORE WATER PRESSURE MEASURING DEVICE.

For primary bibliographic entry see Field 2G.
W76-06477

DEVELOPMENT OF METHODOLOGY FOR EVALUATION AND PREDICTION OF AVALANCHE HAZARD IN THE SAN JUAN MOUNTAIN AREA OF SOUTHWESTERN COLORADO.

Colorado Univ., Boulder. Inst. of Arctic and Alpine Research.
For primary bibliographic entry see Field 2C.
W76-06605

EVALUATION OF AIRBORNE RAINDROP SIZE-DISTRIBUTIONS MEASUREMENTS FOR IMPROVING RADAR RAINFALL ESTIMATES.

Meteorology Research, Inc., Altadena, Calif.
For primary bibliographic entry see Field 2B.
W76-06608

SATELLITE SUPPORT TO THE HIPLEX ACTIVITIES FOR 1975.

Colorado State Univ., Fort Collins. Dept. of Atmospheric Science.
For primary bibliographic entry see Field 3B.
W76-06613

SEASONAL STREAMFLOW ESTIMATION EMPLOYING SATELLITE SNOWCOVER OBSERVATIONS.

National Aeronautics and Space Administration, Greenbelt, Md. Goddard Space Flight Center.
For primary bibliographic entry see Field 4A.
W76-06638

ENVIRONMENTAL APPLICATIONS OF ADVANCED INSTRUMENTAL ANALYSIS: ASSISTANCE PROJECTS, FY 74.

Southeast Environmental Research Lab., Athens, Ga.
For primary bibliographic entry see Field 5A.
W76-06647

USE OF RADAR INFORMATION IN DETERMINING FLASH FLOOD POTENTIAL,
National Weather Service, Garden City, N.Y.
Eastern Region.
For primary bibliographic entry see Field 4A.
W76-06653

DEVELOPMENT OF SNOW WATER EQUIVALENT SURVEY METHODS USING AIRBORNE GAMMA MEASUREMENTS,
EG and G, Inc., Las Vegas, Nev.
For primary bibliographic entry see Field 2C.
W76-06659

OPERATIONAL CHARACTERISTICS OF THE DECCA LAMBDA (6f) POSITIONING SYSTEM OVER FRESH WATER,
Canadian Hydrographic Service, Ottawa (Ontario).
F. L. DeGrasse, and P. Brunaus.
IFYGL Tech. Man. No. 7; (1975), 52 p.

Descriptors: *Lakes, *Lake Ontario, *Navigation, *Electromagnetic waves, Radio waves.
Identifiers: Radio wave propagation, Phase lag, DECCA Lambda positioning system.

Establishment of the DECCA Lambda (6f) positioning system for the International Field Year Great Lakes study of Lake Ontario and Basin provided an opportunity to evaluate the equipment in the hyperbolic mode and more importantly to determine phase lag effect on electromagnetic waves in a fresh water environment. A number of calibrations/evaluations were carried out throughout the Field Year under varying meteorological and land-sea media conditions to determine a more accurate figure for Velocity of Propagation of radio waves over fresh water and its application to electronic positioning in similar fresh water bodies. The bathymetric survey of Lake Ontario will be accounted for in some detail together with the automated collecting, processing and portrayal of the data. This survey is the first major effort at metrication in the Great Lakes. (NOAA)
W76-06662

SOIL MOISTURE SURVEY EXPERIMENT AT LUVERNE MINNESOTA, DATE OF SURVEY: MAY 12, 1975,
EG and G, Inc., Las Vegas, Nev.
For primary bibliographic entry see Field 2G.
W76-06663

SOIL MOISTURE SURVEY EXPERIMENT AT PHOENIX, ARIZONA, DATE OF SURVEY: MARCH 18, 1975,
EG and G, Inc., Las Vegas, Nev.
For primary bibliographic entry see Field 2G.
W76-06664

SNOW WATER EQUIVALENT SURVEYS OF THE SOURIS RIVER BASIN,
EG and G, Inc., Las Vegas, Nev.
For primary bibliographic entry see Field 2C.
W76-06665

THE MEASUREMENT AND RECORDING OF RAINFALL INTENSITIES,
For primary bibliographic entry see Field 2B.
W76-06692

APPLICATIONS OF AEROSPACE TECHNOLOGY IN THE PUBLIC INTEREST: POLLUTION MEASUREMENT,
Denver Research Inst., Colo.
For primary bibliographic entry see Field 5C.
W76-06710

TELEDETECTION BY AIRPLANE AND SATELLITE IN THE STUDY OF MARINE POLLUTION, (IN FRENCH),
Centre d'Etudes et de Recherches de Biologie et d'Océanographie Médicale, Nice (France).
For primary bibliographic entry see Field 5A.
W76-06717

STUDIES ON THE EFFECT OF SOIL DENSITY, TEMPERATURE AND FERTILIZATION OF THE SOIL MOISTURE, VALUE OBTAINED WITH A DIELECTRIC MEASURING TECHNIQUE, (IN GERMAN),
For primary bibliographic entry see Field 2G.
W76-06727

THE DETERMINATION OF CARBOHYDRATES IN NATURAL WATERS: A COMPARISON OF PAPER CHROMATOGRAPHIC: COLORIMETRIC AND ENZYMATIC METHODS, (IN GERMAN),
Freiburg Univ. (West Germany). Limnologisches Institut.
For primary bibliographic entry see Field 5A.
W76-06773

THE TECHNIQUE OF REMOVING LARGE UNDISTURBED SAMPLES OF LAKE SEDIMENT: AN IMPROVED BORE PLUMB, (IN GERMAN),
For primary bibliographic entry see Field 2J.
W76-06776

VEGETATION IN LAKE TAMNAREN: INTERPRETATION OF AERIAL PHOTOS AND DESCRIPTION OF THE VEGETATION, (IN SWEDISH),
Uppsala Univ. (Sweden). Inst. of Limnology.
For primary bibliographic entry see Field 2H.
W76-06781

FLOODING EFFECTS ON LIGHT REFLECTANCE, TRANSMITTANCE, AND ABSORPTANCE OF COTTON (GOSSYPIMUM HIRSUTUM) LEAVES,
Agricultural Research Service, Weslaco, Tex.
For primary bibliographic entry see Field 2I.
W76-06794

7C. Evaluation, Processing and Publication

APPLICATIONS OF LINEAR TIME SERIES MODELS AND STEPWISE REGRESSION MODELS TO SELECTED WATER QUALITY DATA ON THE CONNECTICUT RIVER,
Massachusetts Univ., Amherst. School of Health Sciences.
For primary bibliographic entry see Field 5B.
W76-06157

WATER INFORMATION SYSTEMS CATALOG.
Minnesota Water Resources Council, St. Paul.
Water and Related Land Resources Information Systems Subcommittee.
For primary bibliographic entry see Field 10C.
W76-06256

REMOTE SENSING OF RESOURCES IN ARID LANDS,
Arizona Univ., Tucson. Office of Arid Lands Studies.
For primary bibliographic entry see Field 7A.
W76-06260

ATLAS OF ARIZONA.
Arizona Information Press, Yuma. 1976. 49 p. S. Bahre, editor.

Descriptors: *Maps, *Arizona, *Groundwater, *Drainage basins, *River flow, *Precipitation(Atmospheric), Data collections, Rivers, Water resources, Resources, Temperature, Hydrologic data, Regional analysis, Climates, Vegetation, Geology, Soils, Geomorphology, Land use, Land ownership, Irrigated land, Recreation, Bibliographies.

This atlas provides a graphic representation of the resources of Arizona. It contains maps of the state's rainfall, drainage areas, river flow, selected groundwater wells, average temperatures, climate, vegetation, general geology, soils, relief, physiographic cross sections, land ownership, and land utilization including crop distribution and irrigated areas, the Central Arizona Project, and recreational areas. An emphasis is placed on maps that are readable by all segments of society. Also included is a bibliography of Arizona maps. (Robinet-Arizona)
W76-06263

AN APPROACH TO A WATER QUALITY INDEX FOR CANADA,
Department of the Environment, Ottawa (Ontario). Science Policy Branch.
For primary bibliographic entry see Field 5G.
W76-06272

DATA COLLECTION SYSTEMS AND THEIR IMPACT ON THE FUTURE DEVELOPMENT OF HYDROLOGY,
Department of the Environment, Reading (England). Water Data Unit.
For primary bibliographic entry see Field 7A.
W76-06277

FLOOD PLAIN INFORMATION: NORTH FORK ST. LUCIE RIVER, ST. LUCIE COUNTY, FLORIDA.
Army Engineer District, Jacksonville, Fla.
For primary bibliographic entry see Field 4A.
W76-06282

FLOOD PLAIN INFORMATION: UVAS-CARNADERO CREEK, PAJARO RIVER TO UVAS RESERVOIR, SANTA CLARA COUNTY, CALIFORNIA.
Army Engineer District, San Francisco, Calif.
For primary bibliographic entry see Field 4A.
W76-06283

FLOOD PLAIN INFORMATION: STILL AND MAD RIVERS, TOWN OF WINCHESTER, CONNECTICUT.
Corps of Engineers, Waltham, Mass. New England Div.
For primary bibliographic entry see Field 4A.
W76-06284

FLOOD PLAIN INFORMATION: COASTAL AREAS, SARASOTA COUNTY, FLORIDA.
Army Engineer District, Jacksonville, Fla.
For primary bibliographic entry see Field 4A.
W76-06285

COMPUTERIZED MONTHLY REPORTS, COST-EFFECTIVE ALTERNATIVE,
Massachusetts Univ., Amherst. Dept. of Civil Engineering.
F. A. DiGiano, R. J. DuPuis, and P. J. Williams.
Water and Sewage Works, Vol. 122, No. 12 p 49-53, December, 1975. 5 fig, 2 tab.

Descriptors: *Waste treatment, Treatment facilities, Waste water treatment, Monitoring, Costs, *Computer programs.
Identifiers: Pilot tests, Cost-effectiveness.

Field 7—RESOURCES DATA

Group 7C—Evaluation, Processing and Publication

An optical scanning form and computer program, DTECTR (Diagnostic Testing of Efficiency by Computerization of Treatment Reports), have been developed to record, review, evaluate and store monthly operational data from waste water treatment plants. Operators at eight waste treatment plants in Massachusetts will soon participate in a pilot testing program of DTECTR. The computer program will evaluate plant operations rapidly, store data, make the operational data easily accessible to engineers and regulatory agencies, provide flexibility for expansion of data evaluations, and reduce staff time normally spent compiling such information. The system, developed by the University of Massachusetts Division of Water Pollution Control, includes an optical scanning form to be filled out by the plant operator. Space is provided for recording the following daily data: rain, flow, sludge recycle, dissolved oxygen, pH, chlorine residual, settleable solids, total coliform, fecal coliform, phosphorus and nitrogen in final effluent, suspended solids, BOD, and sludge settleability. Estimates of cost indicate that implementation of DTECTR by one state regulatory agency would result in a cost of \$341 per month in contrast to \$600 per month as required for present staff data analysis. (Loustau-FIRL)
W76-06300

FLOOD PLAIN MAPPING.
Hydrocomp, Inc., Palo Alto, Calif.
For primary bibliographic entry see Field 2E.
W76-06312

FULL AUTOMATION GOAL OF WATER RECLAMATION PLANT.
Brown and Caldwell, Inc., Walnut Creek, Calif.
Process Control Div.
For primary bibliographic entry see Field 5D.
W76-06337

FLOOD PLAIN INFORMATION: COASTAL AREAS, ST. LUCIE COUNTY, FLORIDA.
Army Engineer District, Jacksonville, Fla.
For primary bibliographic entry see Field 4A.
W76-06354

FLOOD PLAIN INFORMATION: VAN DUZEN RIVER, HUMBOLDT COUNTY, CALIFORNIA.
Army Engineer District, San Francisco, Calif.
For primary bibliographic entry see Field 4A.
W76-06355

FLOOD PLAIN INFORMATION: SAN TIMOTEO CREEK, VICINITY OF LOMA LINDA, SAN BERNARDINO COUNTY, CALIFORNIA.
Army Engineer District, Los Angeles, Calif.
For primary bibliographic entry see Field 4A.
W76-06356

FLOOD PLAIN INFORMATION: UPPER ST. VRAIN CREEK, VOLUME IV, BOULDER COUNTY, COLORADO.
Army Engineer District, Omaha, Nebr.
For primary bibliographic entry see Field 4A.
W76-06357

FLOOD PLAIN INFORMATION: SALMON BROOK, EAST BRANCH AND WEST BRANCH, GRANBY AND E. GRANBY, CONNECTICUT.
Corps of Engineers, Waltham, Mass. New England Div.
For primary bibliographic entry see Field 4A.
W76-06358

FLOOD PLAIN INFORMATION: CYPRESS CREEK, ORANGE COUNTY, FLORIDA.
Army Engineer District, Jacksonville, Fla.
For primary bibliographic entry see Field 4A.
W76-06359

RESEARCH PROJECTS IN GLACIOLOGY - 1974.
Department of the Environment, Ottawa (Ontario). Inland Waters Directorate; and Department of the Environment, Ottawa (Ontario). Water Resources Branch.
For primary bibliographic entry see Field 2C.
W76-06368

WATER QUALITY DATA ALBERTA 1961 - 1973.
Department of the Environment, Ottawa (Ontario). Inland Waters Directorate; and Department of the Environment, Ottawa (Ontario). Water Quality Branch.
1975. English and French language versions.

Descriptors: *Water quality, *Data collections, *Physical properties, *Biological properties, Water, Oxygen, Nitrogen, Calcium, Methodology, Alkaline water, Heavy metals, *Canada.
Identifiers: *Alberta.

Tables on water quality data in Alberta from 1961 to 1973 are presented. This report is one of a series covering the major regions of Canada. These compilations of approximately 10 years data are an extension of the water survey reports of the industrial water resources of Canada, a monitoring program which began in 1947. (Environment Canada)
W76-06374

SEDIMENT DATA, CANADIAN RIVERS 1972.
Department of the Environment, Ottawa (Ontario). Applied Hydrology Div.
Inland Waters Directorate, Water Survey of Canada, 1975, 328 p.

Descriptors: *Sediments, *Rivers, *Data collections, *Canada, Reservoirs, Canals, Erosion, Hydrology, Geomorphology, Streamflow, Drainage, Ditches, Fish, Habitats.

Tables of sediment data on Canadian rivers are presented. These tables contain data on streamflow, daily suspended sediment discharges, daily mean suspended sediment concentration, particle-size distribution of suspended sediment, particle-size distribution of bed load, particle-size distribution of bed material, and water temperature. (Environment Canada)
W76-06376

SURFACE WATER DATA, REFERENCE INDEX, CANADA 1975.
Canada Centre for Inland Waters, Burlington (Ontario); and Department of the Environment, Ottawa (Ontario). Water Resources Branch.
Surface Water Data, 1975, 276 p. English and French language versions.

Descriptors: *Surface waters, *Surveys, *Data collections, *Canada, Rivers, Sediments, Stations, Lakes, Drainage area, Hydrometry, Gaging stations, Telemetry, Temperature, Codes, Collections.

Hydrometric surveys are conducted by the Water Survey of Canada under various agreements with the provinces and territories. The main body of this index is a tabulation of stations showing station number and name, drainage area, gauge location, discharge records, type of gauge, operation schedule, and remarks. The names of rivers and lakes for which data are available are given in a station number index and an alphabetical index. (Environment Canada)
W76-06377

A METHOD FOR ESTIMATING SNOWFALL AMOUNTS.
Oregon State Univ., Corvallis. Dept. of Forest Engineering.
For primary bibliographic entry see Field 2C.
W76-06408

CLASSIFICATION OF WETLANDS VEGETATION USING SMALL SCALE COLOR INFRARED IMAGERY.
Smithsonian Institution, Edgewater, Md. Chesapeake Bay Center for Environmental Studies.
For primary bibliographic entry see Field 2L.
W76-06411

MODELING TECHNIQUES FOR GROUND-WATER EVALUATION.
Illinois State Water Survey, Urbana.
For primary bibliographic entry see Field 2F.
W76-06413

A PRACTICAL MONTHLY OPTIMUM OPERATIONS MODEL.
Bureau of Reclamation, Sacramento, Calif. Mid-Pacific Regional Office; and Bureau of Reclamation, Sacramento, Calif. Water and Power Control Div.
For primary bibliographic entry see Field 4A.
W76-06436

FLOOD-PRONE AREAS OF GADSDEN COUNTY, FLORIDA.
Geological Survey, Tallahassee, Fla.
R. P. Rumenik, C. A. Pascale, and D. F. Tucker.
Water-Resources Investigations 31-75, 1975. 1 sheet, 4 fig, 1 tab, 5 ref.

Descriptors: *Flood profiles, *Maps, *Florida, Flood data, Flood peak, Flood discharge, Flood recurrence interval, Flood plains, Hydrologic data, Flood damage, Flood control.
Identifiers: Gadsden County (Fla).

The map of Gadsden County, Fla., provides a generalized reference for individuals interested in land use and development, for agencies formulating zoning regulations, and for insurance companies. The 100-year flood elevation is used for the national standard as the degree of protection needed when developing or considering development in flood-prone areas. Major flooding in Gadsden County occurred three times in less than 30 years. The most recent major flood was in September 1969 when more than 20 inches of rain fell in the Quincy-Havana area during a 3-day period. The maximum rainfall of record occurred at Quincy on September 21 when 10.87 inches of rain fell in six hours. Although no loss of life resulted from the flood, considerable damage did occur to cottages, mobile homes, roads, and bridges as flood levels exceeded the 100-year flood on most major streams in the county. Examples of flooding on the Little River at U. S. Highway 90 and the Ochlockonee River at State Highway 20 are shown. U. S. Highway 90 remained closed to traffic nearly 36 hours owing to structural damage to the Little River bridge. (Woodard-USGS)
W76-06443

THE LOWER WILCOX AQUIFER IN MISSISSIPPI.
Geological Survey, Jackson, Miss.
E. H. Boswell.
Water-Resources Investigations 60-75 (open-file report), February 1976. 3 sheets, 16 fig, 3 tab, 12 ref.

Descriptors: *Groundwater resources, *Aquifer characteristics, *Water yield, *Water quality, *Mississippi, Hydrogeology, Water utilization, Water supply, Groundwater recharge, Withdrawal, Maps, Water level fluctuations, Projections.
Identifiers: *Lower Wilcox aquifer (Miss).

This 'atlas', the second in a series, describes the character, the potential, and the extent of development of the lower Wilcox aquifer in Mississippi. Sediments composing the Wilcox Group are exposed in a curving belt that extends from Lauderdale County to Tippah County. In much of the

area where the lower Wilcox aquifer contains fresh water, all deeper aquifers are saline. Although minor aquifers occur in the middle and upper parts of the Wilcox Group, the Meridian-upper Wilcox aquifer is the next shallower extensive source for large supplies of groundwater. The largest withdrawals of water from the lower Wilcox are made in Lauderdale County where nearly 7 mgd is pumped (1975). The total production from the aquifer in Mississippi in 1975 was about 16 mgd and was distributed over 25 counties. The water is mostly of the sodium bicarbonate type. The dissolved-solids concentration is very low in the outcrop area, and the rate of increase in mineralization with depth is small in most of the area. Chloride is likely to exceed 200 mg/l only when the dissolved-solids concentration exceeds 700 mg/l. (Woodard-USGS)
W76-06444

THE MIOCENE AQUIFER SYSTEM IN MISSISSIPPI,
Geological Survey, Jackson, Miss.
R. Newcome, Jr.
Water-Resource Investigations 46-75, December 1975. 3 sheets, 12 fig, 3 tab, 15 ref.

Descriptors: *Groundwater resources, *Aquifer characteristics, *Well data, *Water quality, *Mississippi, Hydrologic data, Hydrogeology, Alluvial aquifers, Water wells, Water yield, Water utilization, Groundwater recharge, Water analysis, Chemical analysis, Water temperature.
Identifiers: *Miocene aquifer system(Miss).

This report on the Miocene aquifer system in Mississippi is the first in a series dealing specifically with the statewide occurrence of individual aquifer systems. Most of the southern half of Mississippi is underlain by a series of irregular and locally lenticular sand and clay beds of Miocene age. Southwest of a line from Warren County on the west through Wayne County on the east, these sediments form a wedge that thickens seaward and has its base about 5,500 ft below sea level at the southern tip of Hancock County. The beds dip seaward at 30 to 100 ft/mi, the rate of dip being least in the near-surface zone. The Miocene aquifer system is the largest potential source of groundwater supplies in the State. In the 17,000 sq mi area of its occurrence it is currently tapped for about 120 Mgal/d, slightly more than one-fourth of the groundwater withdrawn in Mississippi for uses other than irrigation. Only the upper few hundred feet of the system have been significantly developed, and many thick aquifers remain untapped. The quality of the water is generally good, the only substantial problem being excessive iron in places. (Woodard-USGS)
W76-06445

RAINFALL-RUNOFF DATA FROM SMALL WATERSHEDS IN COLORADO, OCTOBER 1971 THROUGH SEPTEMBER 1974,
Geological Survey, Denver, Colo.
G. L. Ducret, Jr., and H. E. Hodges.
Colorado Water Resources Basic-Data Release No 38, Colorado Water Conservation Board, Denver, 1975. 540 p, 2 fig, 3 tab, 12 ref.

Descriptors: *Rainfall-runoff relationships, *Small watersheds, *Colorado, *Basic data collections, Stream gages, Rain gages, Streamflow, Computer programs.

All significant rainfall-runoff data collected in Colorado small watersheds from October 1971 through September 1974 by a network of gages are presented. Detailed records of rainfall and stream stage are collected at each station by the operation of two digital recorders which code the data on 16-channel paper tape at 5-minute intervals. Use of a single timer provides for simultaneous actuation of both recorders. Detailed station-description information is included for every station in the study. A computer program developed by the U.S. Geological

Survey uses the stage-discharge relation at a gage to convert time and stage data into a printout of time versus discharge. Because the intakes to the gage wells are generally located above the bottoms of the stream channels, there is a flow rate at each station below which the discharges must be estimated to complete the hydrographs. (Woodard-USGS)
W76-06446

HYDROLOGIC DATA FOR THE IDAHO NATIONAL ENGINEERING LABORATORY SITE, IDAHO, 1971 TO 1973,
Geological Survey, Idaho Falls, Idaho.
For primary bibliographic entry see Field 5B.
W76-06447

WATER RESOURCES OF THE THRUST BELT OF WESTERN WYOMING,
Geological Survey, Cheyenne, Wyo.
G. C. Lines, and W. R. Glass.
For sale by USGS, Reston, Va. 22092; price \$2.00 per set. Hydrologic Investigations Atlas HA-539, 1975. 3 sheets, 38 ref.

Descriptors: *Water resources, *Surface waters, *Groundwater resource, *Water quality, *Wyoming, Water supply, Water utilization, Water yield, Consumptive use, Streamflow, Aquifers, Maps, Hydrographs, Contours, Thermal springs.
Identifiers: *Thrust belt(Western Wyo).

This atlas report describes the results of one of a series of water-resources reconnaissance studies of large areas in Wyoming by the U.S. Geological Survey in cooperation with the Wyoming State Engineer. The purposes of the study are to obtain a general knowledge of the occurrence, availability, and quality of groundwater and to summarize flow characteristics and chemical quality of water in major streams in the thrust belt of western Wyoming. The thrust belt is an elongate, nearly rectangular area of about 5,300 sq mi in the Middle Rocky Mountain physiographic province. The largest use of water in the area is for irrigation of alfalfa, grass hay, and pasture to complement livestock grazing on the vastly larger areas of forest and range land. In that part of the Bear River basin that is in Wyoming, an estimated 58,700 acres were irrigated in 1970 (Hunter and others, 1971); only about 2,000 acres of this total was irrigated with water from wells. Industrial water use in 1970 is estimated at 6 mgd with about 80 percent of the water derived from surface-water sources. Approximately two-thirds of the estimated 18,000 people that lived in the study area in 1970 were served by municipal water supplies in Afton, Cokeville, Evanston, Kemmerer, Jackson, and Thayne. Estimated use in 1970 by these municipal supplies was 5.4 mgd. Three areas of thermal-water discharge are known in the area. (Woodard-USGS)
W76-06448

PRELIMINARY HYDROGRAPHY AND HISTORIC TERMINAL CHANGES OF COLUMBIA GLACIER, ALASKA,
Geological Survey, Tacoma, Wash.
A. Post.

For sale by USGS, Reston, Va., 22092, price \$1.75 per set. Hydrologic Investigations Atlas HA-539, 1975. 3 sheets, 14 ref.

Descriptors: *Glaciers, *Hydrography, *Mapping, *Movement, *Alaska, Discharge(Water), Climatology, Data collections, Monitoring, Aerial photography, Geomorphology.
Identifiers: *Columbia Glacier(Alaska), Historic terminal changes.

Data on 3 sheets of maps show that for more than 70 years Columbia Glacier's terminus in Alaska has been virtually stable, with frequent temporary advances being balanced retreats of the same mag-

nitude. This stability is in marked contrast to other glaciers in the area, most of which have thinned and retreated during this interval, the only other notable exceptions being tidal glaciers which have previously made large-scale drastic retreats and which are currently advancing. Columbia Glacier's extended position and advances in recent decades over areas not glaciated for more than 9,000 years (J. H. Mercer, written commun., 1975) are anomalous. Very large embayments which form some years in the glacier's terminus cliff may present a serious hazard to the glacier's continued stability. Drastic retreat with associated increased iceberg discharge could occur within a few years should the glacier retreat from the shoals. These fluctuations at the terminus and changes in thickness in other parts of the glacier are being carefully monitored in order to predict the glacier's future stability. (Woodard-USGS)
W76-06449

PHYSICAL AND CLIMATIC CHARACTERISTICS ALONG KANSAS STREAMS,
Geological Survey, Lawrence, Kans.
C. V. Burns, D. V. Maddy, P. R. Jordan, and J. M. McNellis.
Kansas Water Resources Board Topeka, Streamflow Characteristics Technical Report No 13, January 1976. 41 p, 8 ref.

Descriptors: *Physical properties, *Channel morphology, *Climatic data, *Streams, *Kansas, Data collections, Streamflow, Drainage area, Water temperatures, Hydrologic cycle, Soil properties, Vegetation, Trees, Information retrieval, Computer programs.

Physical and climatic characteristics of streams are presented from data collected at gaging stations and other selected sites in and adjacent to Kansas. Examples of the 30 characteristics listed include main channel length, percent timber area, and 50-year 24-hour rainfall. Data are included for about 600 locations. Some of the data have been published in numerous reports some have remained in the files, and some have been updated as more information has become available. Data available have been compiled as part of a cooperative program between the Kansas Water Resources Board and the U.S. Geological Survey. The computer program (named WIDSAR) is written in Fortran IV and consists of a main program with two subroutines that control the processing and production of the tables desired. (Woodard-USGS)
W76-06450

WATER RESOURCES DATA FOR GEORGIA, WATER YEAR 1975,
Geological Survey, Doraville, Ga.
Water-Data Report GA-75-1, February 1976. 368 p, 4 fig, 5 tab, 32 ref.

Descriptors: *Basic data collections, *Surface waters, *Georgia, *Streamflow, *Water quality, Sediment transport, Gaging stations, Flow rate, Sampling sites, Water analysis, Chemical analysis, Water temperature, Lakes, Reservoirs, Water levels, Hydrologic data.

Water resources data for the 1975 water year for Georgia consist of records of stage, discharge, and water quality of streams; stage and contents of lakes and reservoirs. This report contains discharge records for 91 gaging stations; stage only records for one gaging station; stage and contents for 16 lakes and reservoirs water quality for 16 continuous stations and 78 periodic stations. Also included are 99 crest-stage partial-record stations and two low-flow partial-record stations. Additional water data were collected at various sites, not part of the systematic data collection program, and are published as miscellaneous measurements. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State and Federal agencies in Georgia. (Woodard-USGS)

Field 7—RESOURCES DATA

Group 7C—Evaluation, Processing and Publication

W76-06451

GEOLOGIC AND WATER-SUPPLY REPORTS AND MAPS—WYOMING, JULY 1975,
Geological Survey, Reston, Va.
For primary bibliographic entry see Field 10C.
W76-06456

GROUND-WATER IN NEW MEXICO, 1973,
Geological Survey, Albuquerque, N. Mex.
J. D. Hudson.
New Mexico State Engineer, Santa Fe, Basic-Data Report, 1975. 99 p, 32 fig, 62 tab, 47 ref.

Descriptors: *Groundwater resources, *Water level fluctuations, *Observation wells, *Basic data collections, *New Mexico, Well data, Aquifers, Precipitation (Atmospheric), Hydrographs.

Water levels were measured in a network of about 1,600 observation wells in 35 areas located within seven of the nine major surface-water drainage basins in New Mexico. Measurements were made in January or February 1974 and reflect water-level changes with measurements made in January or February 1973. Maps showing observation-well locations and water-level changes for 1973 are included for most areas. The water-level data are used by the U.S. Geological Survey and the State Engineer of New Mexico in evaluating the ground-water resources of the State. (Woodard-USGS)
W76-06460

SYSTEMATIC DESIGN OF LEGAL REGULATIONS FOR OPTIMAL SURFACE -GROUND-WATER USAGE - PHASE 2,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
For primary bibliographic entry see Field 4B.
W76-06551

DETERMINATION OF R-Z RELATIONSHIPS FOR WEATHER RADAR USING COMPUTER OPTIMIZATION TECHNIQUES,
South Dakota School of Mines and Technology, Rapid City. Inst. of Atmospheric Sciences.
For primary bibliographic entry see Field 2B.
W76-06604

DEVELOPMENT OF AN EXPERIMENTAL HYDROMETEOROLOGICAL DATA COLLECTION NETWORK,
Western Scientific Services, Inc., Fort Collins, Colo.
For primary bibliographic entry see Field 2B.
W76-06606

OPTIMAL SAMPLING AND OBJECTIVE ANALYSIS,
Eddy (Amos), Inc., Norman, Okla.
For primary bibliographic entry see Field 2B.
W76-06609

A GENERALIZED STREAMFLOW SIMULATION SYSTEM, CONCEPTUAL MODELING FOR DIGITAL COMPUTERS,
National Weather Service, Sacramento, Calif. River Forecast Center.
For primary bibliographic entry see Field 2A.
W76-06634

CORRELATION OF DUAL-CHANNEL AIRBORNE IR DATA WITH SOIL MOISTURE MEASUREMENTS,
Development and Resources Transportation Co., Silver Spring, Md.
For primary bibliographic entry see Field 2C.
W76-06660

FORTRAN GRAPHICS PROGRAMS FOR PHYSICAL OCEANOGRAPHIC AND TIME SERIES DATA,
Rhode Island Univ., Kingston. Graduate School of Oceanography.
W. P. Kramer, and R. H. Weisberg.
Marine technical report 46, (1975), 92 p. NSF Grant OCD74-01739 401.

Descriptors: Computers, *Computer programs, *Data collections, Data processing, Data storage and retrieval, Charts, Statistics, *Time series analysis, Oceanography.
Identifiers: FORTRAN, *Physical oceanographic data, Time series data.

A group of FORTRAN programs written to display time series data, X-Y data, and the results of time series analysis are documented. Separate programs are used to plot variables on any combination of linear and logarithmic (base 10) axes. Originally written to plot physical oceanographic data, these programs may be used in wider applications due to their flexibility. Parameters which determine plot size, numbering and labelling of axes are user supplied variables. The data storage device and format are also supplied at execution time. All of these programs are stored in compiled form for use at URI. Listings are supplied in the appendices for other users. (NOAA)
W76-06661

SYNTHESIS OF BASIN RESPONSE WITH INADEQUATE DATA,
Osmania Univ., Warangal (India). Regional Engineering Coll.
For primary bibliographic entry see Field 2A.
W76-06675

METHOD FOR REDUCING SINGLE DISCHARGE MEASUREMENTS TO THE AVERAGE DISCHARGE OF THE LOW-FLOW PERIOD,
For primary bibliographic entry see Field 2E.
W76-06679

PUMPING TEST ANALYSIS WHEN PARAMETERS VARY WITH DEPTH,
Birmingham Univ., (England). Dept. of Civil Engineering.
For primary bibliographic entry see Field 4B.
W76-06687

8. ENGINEERING WORKS

8A. Structures

PREVENTION AND CONTROL OF CULVERT ICING, SUMMARY REPORT ON STUDIES FY 1966-70,
Cold Regions Research and Engineering Lab., Hanover, N. H. Experimental Engineering Div.
K. L. Carey, R. W. Huck, and D. A. Gaskin.
Available from the National Technical Information Service, Springfield, Va 22161, as ADA-010 328, \$5.00 in paper copy, \$2.25 in microfiche. Special Report 224, April 1975. 79 p, 46 fig, 7 tab, 10 ref, 2 append.

Descriptors: *Ice, *Culverts, *Highways, *Alaska, Roads, Pipes, Channels, Channel improvement, Conduits, Drainage, Flow, Flow resistance, Flood control, Freezing, Thawing, Heating.
Identifiers: Electrical heating cables, Channel covers.

U.S. Army Cold Regions Research and Engineering Laboratory field inspections and data collection on icing conditions and methods of control prior to 1966 provided background to the overall study. A literature survey, covering primarily

American and Russian experience, and a survey by questionnaire of highway maintenance forces in Alaska provided background to a field study of icing prevention and control covering four winter seasons in Alaska. Climatological, culvert temperature, ground temperature and hydrologic data were collected at Grenac, Steele and Flume Creeks near Fairbanks, Alaska, to extend understanding of icing phenomena. Field trials were conducted at Bear Creek, Grenac Creek, Steele Creek, Moose Creek and Gakona Spring to test three expedient techniques for controlling icing: electric heating cables, channel improvement and channel covers. Electric heating cables and channel deepening proved to be very promising for icing control, and improved installation and operating procedures for electric heating cables were developed during the study. The usefulness of channel covers proved to be rather restricted. Ground temperature data were collected from an array of thermocouples beneath and adjacent to a 24-in corrugated metal culvert at Mile 15 on the Elliott Highway to study the thermal regime surrounding an ice-flooded culvert. These data demonstrated that culvert ends were the critical regions of heat loss. (Sims - ISWS)
W76-06193

THEORY OF WEIRS,
Indian Inst., of Science, Bangalore. Dept. of Civil Engineering.
For primary bibliographic entry see Field 8B.
W76-06416

A STUDY TO ASSESS GOALS FOR USES AND MANAGEMENT OF SHORELINE AND IMPLICATIONS FOR CORPS OF ENGINEERS PROGRAMS,
Coastal Zone Resources Corp. Wilmington, N. C.
For primary bibliographic entry see Field 6B.
W76-06418

INFLATABLE WATER-RETAINING BARRIER,
Pneumatiques, Caoutchouc Manufacture et Plastiques Kleber-Colombes (France), (Assignee). J. V. Ganzinotti.
U.S. Patent No. 3,928,980, 5 p, 12 fig, 6 ref; Official Gazette of the United States Patent Office, Vol 941, No 5, p 2029, December 30, 1975.

Descriptors: *Patents, *Barriers, *Engineering structures, *Dams, *Diversion structures, Rivers, Channels, Flexibility.
Identifiers: Inflatable barriers.

An inflatable water-retaining barrier is made up of one or more flexible membranes forming the enclosure and are used to block a watercourse such as a river. The enclosures are all fastened to a rigid member which extends along the whole length of the enclosures and is intended to be supported by the bank of the water course. The rigid member such as a metal bar or tube prevents the enclosures from deforming longitudinally. Mechanical stresses exerted on the barrier are transferred to the rigid member and thus to the banks. To install such a barrier, it is sufficient to inflate it with air until it floats, to position it on the river upstream of the abutments, to let it be carried along by the current under guidance until the rigid member rests against the abutments or banks and then to let out the air and to fill it with water until it sinks. It is likewise very simple to remove the barrier. The water contained in the inflatable enclosure is expelled and replaced by air, which buoys it and the rigid member up to the surface of the water. (Sinha - OEIS)
W76-06462

8B. Hydraulics

WASTEWATER DISPOSAL BY SUBMERGED MANIFOLDS, Miljopand, Hovik (Norway). Water Pollution Section. For primary bibliographic entry see Field 5B. W76-06387

MENABREA'S NOTE ON WATERHAMMER: 1858, Aberdeen Univ. (Scotland). Dept. of Engineering. A. Anderson. Journal of the Hydraulics Division, American Society of Civil Engineers, Vol. 102, No. HY1, Proceedings Paper 11831, p 29-39, January 1976. 1 tab, 27 ref, 3 append.

Descriptors: *Hydraulics, *Hydraulic transients, *Closed conduits, *Pressure conduits, Pipe flow, *Water hammer, Flow, *History, Fluid mechanics. Identifiers: *Energy analysis.

The earliest analysis of waterhammer is frequently attributed to Jules Michaud in 1878, but in 1858 the Italian engineer, L.F. Menabrea, published a short note on the calculation of water pressures. This little known contribution is, for its time, a remarkable and innovative study, introducing the technique of energy analysis and describing the phenomenon with singular clarity. As it thus appears to deserve wider recognition in the history of waterhammer, the note was translated and an explanatory introduction was provided. The introduction was intended: (1) to demonstrate how close Menabrea came to the derivation of the formula generally attributed to Joukowski, (2) to pinpoint the errors and failures in his analysis, and (3) to examine briefly the reception at the turn of the century of the ideas he first proposed some 40 years earlier. (Morris - ISWS) W76-06388

SKIN FRICTION IN UNSTEADY LAMINAR PIPE FLOW, Universidad Tecnica del Estado, Santiago (Chile). M. F. Letelier, and H. J. Leutheusser. Journal of the Hydraulics Division, American Society of Civil Engineers, Vol. 102, No. HY1, Proceedings Paper 11867, p 41-56, January 1976. 10 fig, 9 ref, 2 append.

Descriptors: *Hydraulic transients, *flow resistance, *Boundary processes, *Closed conduits, Head loss, Flow, *Pipe flow, Analysis, Laminar flow, Unsteady flow. Identifiers: Flow patterns, *Friction coefficient, Oscillation, Time dependence.

The routine approach toward solving problems of unsteady pipe flow utilizes either the concept of a constant friction coefficient, or the model of quasi-steady flow. These two hypotheses were tested using exact analytical solutions and corroborating experimental evidence for two cases of time-dependent laminar pipe flow: (1) The establishment of Poiseuille flow and (2) U-tube oscillations. It was shown that neither of the simplifying assumptions corresponds to reality, and that both tend to severely underestimate the frictional resistance. It was suggested that similar conclusions may also pertain to unsteady turbulent pipe flow. (Morris - ISWS) W76-06389

WAVE FORCES ON BOTTOM-MOUNTED LARGE-DIAMETER CYLINDER, Naval Postgraduate School, Monterey, Calif. Dept. of Mechanical Engineering. C. J. Garrison, F. H. Gehrman, and B. T. Perkins. Journal of the Waterways, Harbors and Coastal Engineering Division, American Society of Civil

Engineers, Vol. 101, No. WW4, Proceedings Paper 11699, p 343-356, November 1975. 4 fig, 10 ref, 2 append.

Descriptors: *Harbors, *Hydrodynamics, *Pipelines, *Waves(Water), *Dynamics, Testing, Dimensional analysis, Pressure, Regression analysis, Strain gages, Uplift pressure. Identifiers: *Underwater pipeline, Inertia force, Wave height.

A systematic series of tests were conducted to determine the horizontal and uplift forces acting on a bottom-mounted horizontal circular cylinder. The maximum value of horizontal force tended to vary linearly with wave height for the test range of 15 to 120 for the ratio of the square of wave period to water depth. The uplift forces comprise two components, dynamic lift and an inertia part. The latter can be represented by Froude-Krilov force. The maximum uplift force generally occurred at the wave trough where the inertial and dynamic components are additive. The uplift force is primarily attributable to the dynamic lift and is dependent on the lift coefficient which is in turn dependent on the relative magnitude of the particle displacement. As the wave height increases, a point is reached where gross flow separation and corresponding reduction in lift coefficient occurs. (Singh-ISWS) W76-06395

STATISTICS OF RANDOM WAVE FIELD, Worley Engineering Inc., Houston, Tex. K. Pajouhi, and C. C. Tung. Journal of the Waterways, Harbors and Coastal Engineering Division, American Society of Civil Engineers, Vol. 101, No. WW4, Proceedings Paper 11734, p 435-449, November 1975. 5 fig, 10 ref, 2 append.

Descriptors: *Coastal engineering, *Gravity waves, *Free surfaces, *Probability, *Fluid mechanics, Statistical methods, Pressure, Velocity, Analytical techniques, Interfaces. Identifiers: *Random wave field, Dynamic pressure, Spectrum analysis.

In the case of random sea waves, the statistical properties of fluid motion are quite different for the cases with and without the free-surface fluctuations phenomenon. Expressions of the probability density function, covariance function and spectrum of dynamic pressure, and vertical and horizontal components of fluid particle velocity in a random wave field were derived with due consideration given the free surface fluctuations phenomenon. The waves were assumed to be unidirectional, stationary, Gaussian, and in deep water. An incompressible inviscid fluid and irrotational motion were assumed. The study indicated: (1) dynamic pressure and fluid particle velocities are all non-Gaussian, (2) dynamic pressure and horizontal velocity possess nonzero means and are skewed, (3) approximate spectra of dynamic pressure and velocity components compare favorably with exact solutions, and (4) the effects of free surface fluctuations on all the quantities examined are most pronounced for points above and around the mean water level. (Singh-ISWS) W76-06397

LARGE WAVE TANK TESTS OF RIPRAP STABILITY, Coastal Engineering Research Center, Fort Belvoir, Va. J. P. Ahrens. Available from the National Technical Information Service, Springfield, Va. 22161 as AD-A012 792, \$4.00 in paper copy, \$2.25 in microfiche. Technical Memorandum No. 51, May 1975. 41 p, 21 fig, 6 tab, 10 ref, append.

Descriptors: *Slope protection, *Slope stability, *Slope stabilization, Waves(Water), Riprap, Embankments, Banks, Slopes, Laboratory tests,

Coastal engineering, Bank protection, Bank stabilization.

Identifiers: *Large wave tank tests, *Riprap stability, Riprap weight, Wave period, Breaker characteristics, Riprap layer thickness, Filter stone size.

Tests of riprap stability under wave attack were conducted at prototype scale in the large wave tank at the U.S. Army Coastal Engineering Research Center (CERC). Wave heights ranging from 1.4 to 6 feet and wave periods ranging from 2.8 to 11.3 seconds were used. Three embankment slopes, 1 on 2.5, 1 on 3.5, and 1 on 5, were tested. The riprap stone was a diorite placed on the embankments by dumping. The median stone weights of the riprap ranged from 27 to 120 pounds. The study showed that wave period, because of its influence on breaker characteristics, has a significant effect on riprap stability. Wave conditions which produce the lowest riprap stability were predictable and were associated with a collapsing-type breaker. For the most dangerous wave conditions, the average stability coefficient was 2.70 for a 1 on 2.5 slope, 2.36 for a 1 on 3.5 slope, and 2.11 for a 1 on 5 slope. (Lee-ISWS) W76-06410

ADVANCES IN HYDROSCIENCE, VOLUME 10-1975, Academic Press, New York, New York, 1975. 414 p.

Descriptors: *Groundwater, *Model studies, *Tides, *Tidal waters, *Porous media, *Heat transfer, *Weirs, *Flow control, Theoretical analysis, Mathematical models, Aquifers, Hydraulics, Flow measurement, Flow characteristics, Equations, Geothermal studies, Numerical analysis, Subsurface waters, Oceans, Aquifer characteristics, Water measurement.

This volume contains four relatively long articles. (1) 'Modeling Techniques for Groundwater Evaluation' were outlined under the groups of analogs, analytical and numerical techniques, and sand tank models. Regional groundwater resource evaluation was emphasized. (2) 'Tidal Theory and Computations' dealt with tidal theory developed since 1964 for analysis of tides, tidal equations, and tidal computations. (3) 'Hydrothermal Convection in Saturated Porous Media' summarized the theories involved. The subject matter will be of great importance to problems such as groundwater pollution, exploration of geothermal energy and oil reservoirs, and constructions in cold regions. (4) 'Theory of Weirs' provides an advanced theoretical analysis of the hydraulics of many types of weirs used for flow measurement and flow control. This analysis will benefit designers and users of such hydraulic structures for water resources development. (See W76-06413 thru W76-06416) (Humphreys-ISWS) W76-06412

MODELING TECHNIQUES FOR GROUNDWATER EVALUATION, Illinois State Water Survey, Urbana. For primary bibliographic entry see Field 2F. W76-06413

TIDAL THEORY AND COMPUTATIONS, Hydraulic Dept. of Deltaworks, The Hague (Netherlands). For primary bibliographic entry see Field 2L. W76-06414

HYDROTHERMAL CONVECTION IN SATURATED POROUS MEDIA, Bordeaux-1 Univ., Talence (France). For primary bibliographic entry see Field 2F. W76-06415

Field 8—ENGINEERING WORKS

Group 8B—Hydraulics

THEORY OF WEIRS,
Indian Inst., of Science, Bangalore. Dept. of Civil Engineering.

N. S. L. Rao.

In: *Advances in Hydrosience*, Volume 10-1975. Academic Press, New York, New York, p 309-406, 1975. 60 fig, 7 tab, 192 ref.

Descriptors: *Weirs, *Flow control, *Flow measurement, *Discharge(Water), *Hydraulic structures, Theoretical analysis, Equations, Shape, Flow characteristics, Flow rates, Discharge coefficient, Measurement, Overflow, Open channels, Hydraulics, Water measurement, Flowmeters, Spillway crests, Flumes, Velocity, Profiles.
Identifiers: *Weir characteristics.

The term weir includes structures such as the depression in the side of a tank, a reservoir, or a channel for passing surplus water, and overflow structures such as a spillway for a dam. This paper involved only the hydraulics of weirs and was limited to flow measurement and control aspects. Specific subject area covered included: (1) channel conditions, weir characteristics, and liquid properties affecting flow over weirs; (2) rectangular and nonrectangular sharp-crested or thin plate weirs; (3) different cross-sectional profile shapes and different longitudinal profile shapes for broad-crested or finite crest width weirs; (4) terminal weirs; (5) end depth characteristics in rectangular and nonrectangular channels for zero height weirs; (6) theorems on proportional weirs, and proportional weirs for flow measurement and flow control; (7) throated flumes with and without humps for flow measurement; (8) v-shaped and labyrinth weirs; and (9) the effects of error, sensitivity, and standardization procedures of accuracy of measurements. The results of this study presented in tables, graphs, and equations will benefit designers and users of weirs for water resources development. (See also W76-06412) (Humpreys-ISWS)

W76-06416

ANALYSIS AND INTERPRETATION OF LITORAL ENVIRONMENT OBSERVATION (LEO) AND PROFILE DATA ALONG THE WESTERN PANHANDLE COAST OF FLORIDA,
Coastal Engineering Research Center, Fort Belvoir, Va.
For primary bibliographic entry see Field 2L.

W76-06637

FIELD STUDIES OF THE THERMAL PLUME FROM THE D. C. COOK SUBMERGED DISCHARGE WITH COMPARISONS TO HYDRAULIC-MODEL RESULTS,
Argonne National Lab. III. Energy and Environmental Systems Div.
For primary bibliographic entry see Field 5B.

W76-06673

CONTROLLING RESERVOIR TRAP EFFICIENCY,

Agricultural Research Service, Columbia, Mo. North Central Watershed Center.
D. L. Rausch, and H. G. Heinemann.
Transactions of the American Society of Agricultural Engineers, Vol. 18, No. 6, p 1105-1113, November-December 1975. 6 fig, 2 tab, 5 ref.

Descriptors: *Trap efficiency, Sedimentation, *Sedimentation rates, *Reservoir design, *Reservoir silting, *Regression analysis, *Spillways, Stratification, Water quality, Surface runoff, Storage, Storage capacity, Erosion, Sediment yield, Particle size, Dead storage, *Missouri.
Identifiers: Non-linear regression, Detention time, Bottom-withdrawal spillway, Siphon spillway, Sediment reduction.

Research on three reservoirs in central Missouri has shown that reservoir sedimentation trap efficiency is affected by the detention time of storm

runoff and by factors governing sediment particle size. Decreasing the detention time can be done by discharging storm runoff from the reservoir with the use of a bottom-withdrawal spillway. With the bottom-withdrawal spillway, the clean water remains in the reservoir and floats above the density currents caused by storm runoff moving to the deepest part of the reservoir. (Terstriep-ISWS)

W76-06682

8C. Hydraulic Machinery

LONG-TERM OPERATION OF STORAGE HYDRO PROJECTS,
British Columbia Univ., Vancouver. Dept. of Civil Engineering.

For primary bibliographic entry see Field 4A.

W76-06434

PRELIMINARY ENGINEERING ANALYSIS, YUMA DESALTING PLANT.

Burns and Roe, Inc., Paramus, N. J.

For primary bibliographic entry see Field 3A.

W76-06547

THE ECONOMICS OF CONVERTING NATURAL GAS-POWERED IRRIGATION PUMPS TO ALTERNATE ENERGY SOURCES IN SOUTHEASTERN ARIZONA,
Arizona Univ., Tucson. Dept. of Agricultural Economics.

For primary bibliographic entry see Field 3F.

W76-06588

PRELIMINARY DESIGN OF A DIESEL-POWERED VAPOR-COMPRESSION PLANT FOR EVAPORATION OF SEAWATER,
Oak Ridge National Lab., Tenn.

For primary bibliographic entry see Field 3A.

W76-06750

8D. Soil Mechanics

CALCULATING TEMPERATURE REGIME OF EARTH DAMS IN PERMAFROST REGIONS,
Moskovskii Inzhenerno-Stroitelnyi Institut (USSR). Dept. of Hydraulic Engineering Structures.

I. S. Moiseyev.

Available from the National Technical Information Service, Springfield, Va 22161, as ADA-010 826, \$8.00 in paper copy, \$2.25 in microfiche. CRREL Draft Translation 450, November 1974. 16 p, 7 fig, 5 ref. Translated from *Gidrotekhnicheskkiye Sooruzheniya* (Hydraulic Engineering Structures), No. 29, p 281-293, 1959.

Descriptors: *Dams, *Earth dams, *Permafrost, *Arctic, Temperature, Measurement, Reservoirs, Thawing, Freezing, Frozen soils, Frozen ground, Cold regions, Structures.

One of the many features of earthfill dams in the regions of persistently frozen soils is the thermal regime in the body and base of the dam. After filling of the reservoir, part of the frozen earth dam will thaw slowly under the effect of water's heat, but after the passage of a certain time (depending on air temperature, temperature of water in the reservoir, material in dam body, and thickness of the permafrost layer) the thawing of the permafrost in the dam practically ceases. A steady state of temperature field sets in, in which the upper part of the dam will be thawed while the central and lower sections will be frozen. In the planning of these dams, it is necessary to establish the advancement of the interface between the thawed and the frozen zone in the period after the filling of the reservoir and the position of this boundary during a stationary state. The temperature fields within earth dams of various profiles at

constant water temperatures in the reservoir and outside air can be calculated using equations presented. (Sims - ISWS)

W76-06191

IDENTIFICATION AND TREATMENT OF DISPERSIVE CLAY SOILS,
Oklahoma State Univ., Stillwater. School of Civil Engineering.

T. A. Haliburton, T. M. Petry, and M. L. Hayden.
July 1975. 14-06-D-7535.

Descriptors: *Clay soils, *Soil erosion, *Laboratory tests, Stabilization, Embankments, Earth dams, Cut slopes, *Erosion control, *Dispersion.
Identifiers: Chemical treatment(Soils).

A method was developed for physical testing for identification of potentially dispersive clay soil. In addition, the test was used to evaluate the effects of chemical treatment in reducing dispersive clay erosion potential. Previous research in soil science and soil engineering covering dispersive clay behavior was reviewed and previous methods for identification of dispersive clay behavior were discussed and evaluated. Based on the shortcomings of previous research, criteria for a physical identification test were developed, and the Physical Erosion Test, developed from these general criteria, was evaluated using 19 different soils from locations where dispersive erosion damage had occurred, plus three non-dispersive control soils. The Physical Erosion Test is believed to be a superior method, compared to other existing procedures, of identifying before the fact dispersive erosion problems, especially for artificially compacted earth structures. Hydrated lime, aluminum sulfate and sodium chloride were effective as chemical stabilizers to reduce dispersive clay erosion potential. (Bureau of Reclamation)

W76-06611

SOIL STABILIZATION FOR EROSION CONTROL,
Purdue Univ., Lafayette, Ind. School of Civil Engineering.

For primary bibliographic entry see Field 4D.

W76-06639

STABILIZATION OF CLAY SOILS AGAINST EROSION LOSS,
Purdue Univ., Lafayette, Ind. School of Civil Engineering.

For primary bibliographic entry see Field 4D.

W76-06640

BUFFALO HARBOR DIKED DISPOSAL SITES: ENGINEERING PROPERTIES AND DRAINAGE CHARACTERISTICS,
State Univ. of New York Coll. at Buffalo.

For primary bibliographic entry see Field 5E.

W76-06666

EVALUATION OF MILL TAILINGS DISPOSAL PRACTICES AND POTENTIAL DAM STABILITY PROBLEMS IN SOUTHWESTERN UNITED STATES. INVESTIGATION REPORT, PHELPS DODGE CORPORATION, MORENCI TAILINGS DAM, MORENCI, ARIZONA, VOLUME 2,
Wahler (W.A.) and Associates, Palo Alto, Calif.
For primary bibliographic entry see Field 5G.

W76-06669

EVALUATION OF MILL TAILINGS DISPOSAL PRACTICES AND POTENTIAL DAM STABILITY PROBLEMS IN SOUTHWESTERN UNITED STATES. INVESTIGATION REPORT, KENNEDY COPPER CORPORATION, MAGNA TAILINGS DAM, MAGNA, UTAH. VOLUME 3,
Wahler (W.A.) and Associates, Palo Alto, Calif.
For primary bibliographic entry see Field 5G.

W76-06670

EVALUATION OF MILL TAILINGS DISPOSAL PRACTICES AND POTENTIAL DAM STABILITY PROBLEMS IN SOUTHWESTERN UNITED STATES. RECONNAISSANCE REPORT, VOLUME 5.

Wahler (W. A.) and Associates, Palo Alto, Calif.
For primary bibliographic entry see Field 5G.
W76-06672

8E. Rock Mechanics and Geology

EVALUATION OF MILL TAILINGS DISPOSAL PRACTICES AND POTENTIAL DAM STABILITY PROBLEMS IN SOUTHWESTERN UNITED STATES. INVESTIGATION REPORT, KENNECOTT COPPER CORPORATION, CHINO LEACHING DUMP, SANTA RITA, NEW MEXICO, VOLUME 4.

Wahler (W. A.) and Associates, Palo Alto, Calif.
Available from the National Technical Information Service, Springfield, Va. 22161, as PB-243 077, \$6.00 in paper copy, \$2.25 in microfiche. Bureau of Mines OFR 50(4)-75, December 1974. 111 p, 14 fig, 1 tab, 15 ref, 2 append. Bu Mines S0110520.

Descriptors: *Waste dumps, *Sampling, *New Mexico, *Waste disposal, *Mining, Geology, Disposal, Leaching, Dams, Drilling, Testing, Piezometers, Rocks, Faults(Geologic), Earthquakes, Seismic studies.
Identifiers: *Mill tailings, *Disposal practices, *Santa Rita(NM), Dam stability, Open pit mine.

This report presented the results of a study of Kennecott Copper Corporation's Chino dump at Santa Rita, New Mexico, carried out as part of a research program conducted for the United States Department of the Interior, Bureau of Mines. The results of this study were to be used as background information along with the results of studies on other selected sites and independent, but related, research to advance the state-of-the-art of mine waste disposal technology and to begin the development of techniques, procedures, and criteria for the investigation, inspection, and review of existing and proposed mine waste embankments. The stability studies described were performed on only one cross section of the leach dump, utilizing data obtained from drilling, sampling, and testing which was limited in nature. Therefore it was not possible to evaluate the degree of safety or adequacy of the leach dump, and the information and data contained in the body of the report must be judged in that light. (See also W76-06669) (Roberts - ISWS)
W76-06671

8G. Materials

MEASUREMENT OF SMALL STRAIN-RATES OVER SHORT TIME PERIODS.

Department of the Environment, Ottawa (Ontario). Inland Waters Directorate; and Department of the Environment, Ottawa (Ontario). Glaciology Div.
For primary bibliographic entry see Field 2C.
W76-06184

THE BEARING CAPACITY OF FLOATING ICE PLATES SUBJECTED TO STATIC OR QUASI-STATIC LOADS, A CRITICAL SURVEY.

Princeton Univ., N. J. Dept. of Civil and Geological Engineering.
A. D. Kerr.
Available from the National Technical Information Service, Springfield, Va 22161, as ADA-009 363, \$4.00 in paper copy, \$2.25 in microfiche. CRREL Research Report 333, March 1975. 43 p, 28 fig, 137 ref. ARPA DACA-70-C-0022.

Descriptors: *Ice, *Bearing strength, *Strength of materials, Mechanical properties, Stress, Pressure, Strength, Loads(Forces), Ice loads, Sea ice, Iced lakes, Rivers, Ice cover, Cold regions.
Identifiers: *Floating ice plates.

Field observations revealed that when a vehicle is small and relatively heavy it may break through the ice plate immediately after placement. In such cases, the plate response may be considered elastic up until failure. For relatively light vehicles, the ice plate deforms elastically at the instant of loading, but sustains the load. However, as time progresses, the ice plate continues to deform in creep, especially in the vicinity of the vehicle, and after a certain time interval the vehicle may break through the ice. The purpose of this report was to present a critical survey of the literature on the bearing capacity of floating ice plates. First, the various analytical attempts to determine the bearing capacity were reviewed. This was followed by a discussion of test data and their relation to the analytical results. The report concluded with a systematic summary of results, a discussion of observed shortcomings, and recommendations for needed investigations. (Sims-ISWS)
W76-06192

WATER-DISTRIBUTION-SYSTEM CORROSION CONTROL.

Indianapolis Water Co., Ind.
R. E. Trivers, J. F. Armacost, and J. A. Lee.
Journal of American Water Works Association, Vol. 66, No. 8, p. 453-455, August, 1974. 3 fig, 2 ref.

Descriptors: *Water distribution(Applied), *Corrosion control, *Films, *Distribution systems, Maintenance, *Indiana.

A corrosion control program has been undertaken by the Indianapolis (Ind.) Water Co., a water system consisting of 1820 miles of gray cast and ductile iron and 13 miles of reinforced concrete water mains. Two recent corrosion-related leaks have prompted action. The first step was to gain knowledge from corrosion specialists, through the Indiana Corrosion Society and Purdue University. To control such problems the limits of corrosion have to be found, soil tests are necessary before new construction, preventive measures must be incorporated into designs, and records of corrosion must be kept. Field testing equipment consists of a two man auger, vibroground in combination with a single probe, a high resistance voltmeter, and an AC ammeter. Lab equipment includes a pH meter, vibroground, and sodium azide-iodine solution to determine the existence of anaerobic sulphate-reducing bacteria. Field testing requires augering to 4.5 feet and collecting a sample to be analyzed in the lab. If corrosive conditions exist pipes are wrapped in 8-mil polyethylene film which is economical to use. In some cases stray current from other utilities causes corrosion which then must be corrected. To determine the extent of corrosion on mains, test holes are dug and hydrostatic pressure tests are made. To date the recognition of corrosion has increased 6 to 16%, and 8 to 10% of new mains have been protected. (Smith - North Carolina)
W76-06276

METHOD FOR COLLECTING SCALE FORMATIONS IN WATER PIPES.

Key II Industries, Camarillo, Calif. (Assignee).
P. Centineo.
U.S. Patent No. 3,936,376, 3 p, 2 fig, 8 ref; Official Gazette of the United States Patent Office, Vol 943, No 1, p 337, February 3, 1976.

Descriptors: *Patents, *Scaling, *Mineral water, *Water utilization, *Water conservation, *Water yield improvement, Corrosion, Damages, Descaling, Pipes, Electrodes, Screens, Separation techniques, Electric fields.
Identifiers: Water pipes.

Conglomerations of charged ions of minerals in a water pipe system resulting from subjecting the water to an alternating electric field are effectively removed from the water flow path by providing two screens. The first screen is located normal to the flow path so that the water flows through the screen. The second screen is located in a chamber connected laterally to a water pipe section carrying the water flow upstream of the first screen. The first and second screens are charged positively and negatively respectively so that the first screen will repel conglomerations of minerals and the second screen will attract the minerals to collect them in the chamber. (Sinha - OEIS)
W76-06479

IDENTIFICATION AND TREATMENT OF DISPERSIVE CLAY SOILS.

Oklahoma State Univ., Stillwater. School of Civil Engineering.
For primary bibliographic entry see Field 8D.
W76-06611

EVALUATION OF MILL TAILINGS DISPOSAL PRACTICES AND POTENTIAL DAM STABILITY PROBLEMS IN SOUTHWESTERN UNITED STATES. INVESTIGATION REPORT, PHELPS DODGE CORPORATION, MORENCI TAILINGS DAM, MORENCI, ARIZONA, VOLUME 2.

Wahler (W. A.) and Associates, Palo Alto, Calif.
For primary bibliographic entry see Field 5G.
W76-06669

EVALUATION OF MILL TAILINGS DISPOSAL PRACTICES AND POTENTIAL DAM STABILITY PROBLEMS IN SOUTHWESTERN UNITED STATES. INVESTIGATION REPORT, KENNECOTT COPPER CORPORATION, MAGNA TAILINGS DAM, MAGNA, UTAH, VOLUME 3.

Wahler (W. A.) and Associates, Palo Alto, Calif.
For primary bibliographic entry see Field 5G.
W76-06670

EVALUATION OF MILL TAILINGS DISPOSAL PRACTICES AND POTENTIAL DAM STABILITY PROBLEMS IN SOUTHWESTERN UNITED STATES. RECONNAISSANCE REPORT, VOLUME 5.

Wahler (W. A.) and Associates, Palo Alto, Calif.
For primary bibliographic entry see Field 5G.
W76-06672

FIBONACCI SEARCH FOR HIGH-YIELD WELL SITES.

California Univ., Davis. Dept. of Civil Engineering.
For primary bibliographic entry see Field 4B.
W76-06686

10. SCIENTIFIC AND TECHNICAL INFORMATION

10B. Reference and Retrieval

WATER INFORMATION SYSTEMS CATALOG.

Minnesota Water Resources Council, St. Paul. Water and Related Land Resources Information Systems Subcommittee.
For primary bibliographic entry see Field 10C.
W76-06256

10C. Secondary Publication And Distribution

WATER INFORMATION SYSTEMS CATALOG.

Minnesota Water Resources Council, St. Paul. Water and Related Land Resources Information Systems Subcommittee.

Field 10—SCIENTIFIC AND TECHNICAL INFORMATION

Group 10C—Secondary Publication And Distribution

Available from the National Technical Information Service, Springfield, Va., 22161, as PB-251 688, \$6.00 in paper copy, \$2.25 in microfiche. December 1974. 197 p. O WRT-A-031-MINN(1).

Descriptors: *Minnesota, *Information exchange, *Information retrieval, Documentation, Publications, Projects, *Data collections.

Identifiers: *Information systems, Information dissemination.

This catalog is a compilation of inventories of water and related land resources information systems used by State agencies, selected colleges, and the University of Minnesota. This catalog is divided into four sections. The first offers an introduction, study outline and rationale for the catalog. The second describes the many information systems inventoried. Due to the complexity of each system it was impossible to order them according to information system function. This section is therefore classified by organization rather than information type. A third section of this catalog is a cross tabulation of information types and organizations. This shows which organizations manage which information types. Within each matrix of the cross tab an Organizational Data Function Code, Data Time/Space Coverage Code and Information System Capability Code are presented. Thus, organization, information types, methodology of collection, use, and analysis are presented in this cross-tabulation. The final section of the catalog is a detailed index of information types which indicates the pages from the catalog on which this information is discussed.

W76-06256

BIBLIOGRAPHY OF STUDIES ON THE DENSITY AND OTHER VOLUMETRIC PROPERTIES FOR MAJOR COMPONENTS IN GEOTHERMAL WATERS, 1928-1974.

Geological Survey, Menlo Park, Calif.

For primary bibliographic entry see Field 4B.

W76-06434

GEOLOGIC AND WATER-SUPPLY REPORTS AND MAPS--WYOMING, JULY 1975,
Geological Survey, Reston, Va.
Geological Survey Publications List, 1975. 55 p.

Descriptors: *Bibliographies, *Publications, *Water resources, *Geology, *Wyoming, Mineralogy, Maps, Information retrieval, Methodology, Costs.

Identifiers: *US Geological Survey reports(Wyo).

This list contains reports and maps published by the U.S. Geological Survey relating to the geology and mineral and water resources of Wyoming. Bulletins, professional papers, water-supply papers, and other book reports for which a price is stated are for sale by the Branch of Distribution, U.S. Geological Survey, 1200 South Eads Street, Arlington, Va., 22202, and from the U.S. Geological Survey, Public Inquiries Offices: 1961 Stout Street, Room 1012, Federal Building, Denver, Col., 80202; and 125 South State Street, Room 8102, Federal Building, Salt Lake City, Utah 84138. Numerous libraries and educational institutions throughout the country are depositories for this material, and a list of depositories is included. (Woodard-USGS)

W76-06456

SOLAR ENERGY TECHNOLOGY, STATE OF THE ART, AN ANNOTATED BIBLIOGRAPHY,
Ocean Engineering Information Service, La Jolla, Calif., Energy Resources Div.

For primary bibliographic entry see Field 03A.

W76-06565

INVENTORY OF FLORIDA COASTAL ZONE PLANNING PUBLICATIONS: VOLUME I, COASTAL COUNTIES AND CITIES.

Florida Dept. of Natural Resources, Tallahassee. Bureau of Coastal Zone Planning.

For primary bibliographic entry see Field 02L.

W76-06566

INVENTORY OF FLORIDA COASTAL ZONE PLANNING PUBLICATIONS: VOLUME II, MULTI-COUNTY PLANNING DISTRICTS.

Florida Dept. of Natural Resources, Tallahassee. Bureau of Coastal Zone Planning.

For primary bibliographic entry see Field 02L.

W76-06567

INVENTORY OF FLORIDA COASTAL ZONE PLANNING PUBLICATIONS: VOLUME III, STATEWIDE.

Florida Dept. of Natural Resources, Tallahassee. Bureau of Coastal Zone Planning.

For primary bibliographic entry see Field 02L.

W76-06568

STATE-OF-THE-ART SURVEY AND EVALUATION OF MARSH PLANT ESTABLISHMENT TECHNIQUES: INDUCED AND NATURAL; VOLUME I: REPORT OF RESEARCH,
Michigan Univ. Ann Arbor, School of Natural Resources.

For primary bibliographic entry see Field 04A.

W76-06635

STATE-OF-THE-ART SURVEY AND EVALUATION OF MARSH PLANT ESTABLISHMENT TECHNIQUES: INDUCED AND NATURAL; VOLUME II: A SELECTED ANNOTATED BIBLIOGRAPHY ON AQUATIC AND MARSH PLANTS AND THEIR MANAGEMENT,
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For primary bibliographic entry see Field 04A.

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10F. Preparation Of Reviews

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